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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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INTRODUCTION

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Certain publications abstracted in *STAR* are given analytic treatment, with citations and abstracts of daughter items following immediately after the parent document. When the subject content of a daughter differs from that of its parent, a cross-reference citation is printed at the end of the category to which the daughter would normally have been assigned.

Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 1859
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 1864
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 1866
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 1868
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 1870
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 1873
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

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08 Computers 1878
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 1880
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 1883
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 1884
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 1885
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 1894
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 1910
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 1917
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 1920
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic 1925
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

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18 Materials, Nonmetallic 1931
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 1934
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 1935
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 1940
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 1943
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 1944
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation.

24 Physics, Atomic, Molecular, and Nuclear 1947
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

25 Physics, Plasma 1947
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

26 Physics, Solid-State 1951
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

27 Propellants 1954
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

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28 Propulsion Systems 1955
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 1959
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 1960
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 1964
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 1968
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 1972
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

34 General 1975
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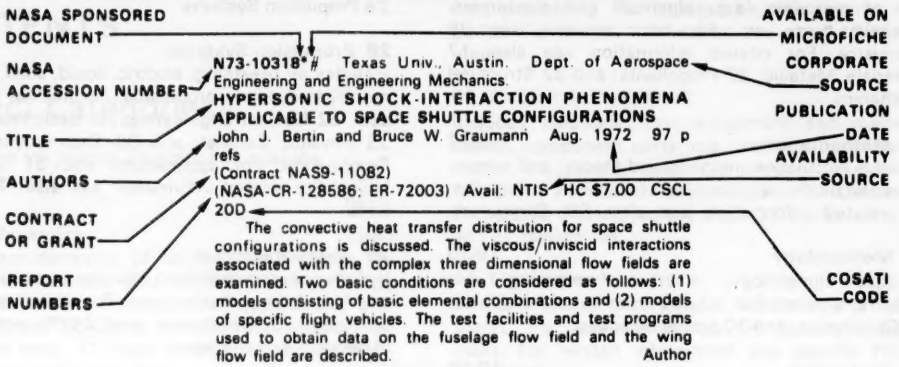
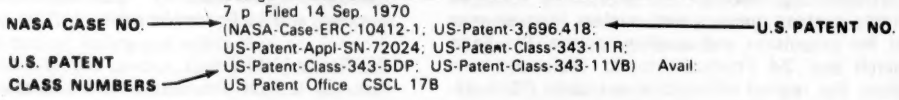


N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D

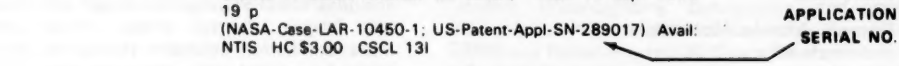
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

PATENT CITATION



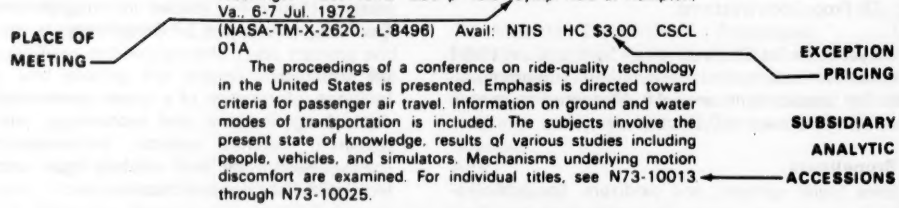
N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION



N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT



N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02)
CSCL 01A

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-24995 Maryland Univ., College Park.
A MANY BODY THEORY OF AERODYNAMIC FORCES Ph.D. Thesis
Charles Frederick McClure 1972 363 p
Avail: Univ. Microfilms Order No. 72-28910

Current concepts in the kinetic theory of gases are applied to the study of drag forces. A theory is developed for the calculation of such forces and it is applied over a wide range in density and Knudsen number. In order to include a wide class of boundary conditions, the full many body drag problem is modeled as a Markov process. A rigorous formulation for the force is obtained which is identical to that obtained from the Liouville equation when there exists a well defined potential of interaction between the gas and the object. Cluster expansions are introduced for the N-body operators and a density expansion for the force is derived. General expressions for the contributions to the drag force are obtained. In particular, the general expression for the triple collision contributions to the n squared term is given.
Dissert. Abstr.

N73-24996 Princeton Univ., N.J.
WIND TUNNEL INTERFERENCE FACTORS FOR HIGH-LIFT WINGS IN CLOSED WIND TUNNELS Ph.D. Thesis
Robert Glenn Joppa 1972 144 p
Avail: Univ. Microfilms Order No. 72-29794

A problem associated with the wind tunnel testing of very slow flying aircraft is the correction of observed pitching moments to free air conditions. The most significant effects of such corrections are to be found at moderate downwash angles typical of the landing approach. The wind tunnel walls induce interference velocities at the tail different from those induced at the wing, and these induced velocities also alter the trajectory of the trailing vortex system. Results are presented comparing the tail interference angles, with and without the effect of vortex wake relocation, which show the importance of the wake shift. In some cases the tail angle corrections are reduced to zero and may even change sign. It is concluded that to correctly calculate the interference velocities affecting pitching moments, the effects of vortex wake relocation must be included.
Dissert. Abstr.

N73-24997 Cincinnati Univ., Ohio.
KELVIN IMPULSE THEORY APPLIED TO LIFT ON AIRFOILS Ph.D. Thesis
James Anthony Delaney 1972 131 p
Avail: Univ. Microfilms Order No. 72-31627

The application of the Kelvin impulse theory to computing lift on airfoils is discussed. The analysis is based on the circulation around the airfoil required to produce lift. A series of five theorems is presented for lift calculation based on variations in the basic parameters in airfoil circulation. Mathematical models are provided to clarify the theoretical concepts. Dissert. Abstr.

N73-24998*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY, SUPPLEMENT 29, MARCH 1973
Mar. 1973 121 p refs
(NASA-SP-7037(29)) Avail: NTIS HC $3.00 CSCL 01A

This special bibliography lists 410 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1972. Author

N73-24999# Aeronautical Research Council, London (England).
[AERODYNAMIC RESEARCH, INCLUDING HEATING, AIRFOILS, AND BOUNDARY LAYER STUDIES, VOLUME 1] Technical Report, 1959
HMSO 1971 662 p refs
Avail: NTIS HC $35.25; HMSO £15.50; PHI $58.14

Research projects in theoretical and practical aerodynamics are presented. The subjects discussed are: (1) leading edge buckling due to aerodynamic heating, (2) effect of a central jet on the base pressure of a cylindrical body in supersonic stream, (3) numerical methods for calculating the zero-lift wave drag and the lift-dependent wave drag of slender wings, (4) wind tunnel tests to determine longitudinal and lateral stability of canard aircraft model, (5) an axially symmetric analog for general three-dimensional boundary layers, and (6) effects of shock-induced boundary layer separation in transonic flight. For individual titles, see N73-25000 through N73-25019.

N73-25000 Ministry of Supply, London (England).
LEADING EDGE BUCKING DUE TO AERODYNAMIC HEATING
E. H. Mansfield *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 1-20 refs (For availability see N73-24999 16-01)
(ARC-R/M-3197; RAE-R-Struct-250)

A formula is derived for determining the onset of leading edge buckling due to aerodynamic heating of wings which are either solid or thin walled with a shear resistant filler. The stresses induced in the wing structure are analyzed. It is shown that buckling begins when the spanwise stress at the leading edge reaches a value which depends on the shear modulus of the material and the geometry of the leading edge. Author

N73-25001 Ministry of Aviation, London (England).
THE EFFECT OF A CENTRAL JET ON THE BASE PRESSURE OF A CYLINDRICAL AFTER-BODY IN A SUPERSONIC STREAM c12
J. Reid and R. C. Hastings *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 21-61 refs Previously issued as RAE-Aero-2621; ARC-21-796 (For availability see N73-24999 16-01)
(ARC-R/M-3224; RAE-Aero-2621; ARC-21796)

An experimental investigation of the factors affecting the

base flow and jet structure behind a cylindrical after-body with a central nozzle was conducted. Tests were made at Mach 2.0 and the boundary layer was turbulent on the afterbody and in the nozzle. Measurements were made of (1) the base pressure, (2) the surface pressure distribution inside the nozzle, (3) the overall thrust, and (4) the nozzle mass flow, over a range of jet pressures. A general method of correlating data on annular base pressures is proposed and discussed. Author

N73-25002 National Physical Lab., Teddington (England). Aerodynamics Div.
OBSERVATIONS OF THE FLOW OVER A TWO DIMENSIONAL 4 PERCENT THICK AEROFOIL ATTRANSONIC SPEEDS c12
B. D. Henshall and R. F. Cash *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 63-81 refs (For availability see N73-24999 16-01)
(ARC-R/M-3180)

Wind tunnel tests were conducted to determine the pressure distributions for a 4 percent thick, circular arc, biconvex airfoil at transonic speeds. The boundary layers on the airfoil were turbulent and were not subjected to artificial transition methods. The pressure distributions for angles of attack of 1, 2, and 5 degrees and various free stream Mach numbers are presented. It was determined that the transonic flow past the airfoil was similar to that for round-nose airfoils. Author

N73-25003 Ministry of Aviation, London (England).
AN EXPERIMENTAL INVESTIGATION AT SUPERSONIC SPEEDS OF THE CHARACTERISTICS OF TWO GOTHIC WINGS, ONE PLANE AND ONE CAMBERED
L. C. Squire *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 83-114 refs Previously issued as RAE-TN-Aero-2620; ARC-21390 (For availability see N73-24999 16-01)
(ARC-R/M-3211; RAE-TN-Aero-2620; ARC-21390)

Tests have been made at supersonic speeds up to M = 2.0 on a thick cambered gothic wing of aspect ratio 0.75, together with tests on the uncambered wing of the same plan-form and thickness. The camber was designed to give attached flow all along the leading edge, and over the whole wing, at one lift coefficient, together with low drag at this lift. The thickness distribution was chosen to have low zero-lift drag and also to eliminate the adverse pressure gradients due to incidence and camber at the design lift. The results show that the drag of the cambered wing is close to the theoretically estimated value at the design lift coefficient: the drag of the plane wing, however, is also of the same magnitude and the reasons for this are discussed. Other properties of the wings are not in agreement with the slender thin wing theory. At the design condition on the cambered wing the flow is attached over the whole wing. Off-the-design condition the leading edge separations on the cambered wing are much weaker than on the plane wing.
Author

N73-25004 Ministry of Aviation, London (England).
FORMULAE FOR CALCULATING THE CAMBER SURFACES OF THIN SWEPTBACK WINGS OF ARBITRARY PLANFORM WITH SUBSONIC LEADING EDGES, AND SPECIFIED LOAD DISTRIBUTION
G. M. Roper *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 115-141 refs Previously issued as RAE-Aero-2623; ARC-21430 (For availability see N73-24999 16-01)
(ARC-R/M-3217; RAE-Aero-2623; ARC-21430)

Formulas for calculating the gradients and ordinates of the camber surfaces of sweptback wings of arbitrary planform with subsonic leading edges, and specified load distribution, are given, including those which have been programmed and used for DEUCE calculations for some swept-back and M-wings with curved leading edges. Some methods for the numerical calculation of singular integrals are given. For polygonal wings with simple load distributions, the equation of the camber surface is given in closed form. This is useful for obtaining approximate results for more general planforms. Author

N73-25005 Ministry of Aviation, London (England).
THE INTERFERENCE ON A THREE DIMENSIONAL JET FLAP WING IN A CLOSED WIND TUNNEL c12
E. C. Maskell *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 143-154 refs Previously issued as RAE-TN-Aero-2650; ARC-21598 (For availability see N73-24999 16-01)
(ARC-R/M-3219; RAE-TN-Aero-2650; ARC-21598)

The theory of wind-tunnel interference is extended to cover interference on the effectiveness of a full-span jet flap issuing from the trailing edge of a high aspect ratio unswept wing. It is shown that, for small constraint, corrections delta c sub j and delta alpha must be added to the observed jet momentum coefficient and wing incidence, respectively. These corrections are derived, together with the corresponding corrections to the observed lift and thrust coefficients. Corrections to the observed downwash field over a limited interval downstream of the trailing edge of the wing are also derived. These lead to a corrected jet path and a downward displacement of the downwash pattern, in addition to the direct increment to the observed downwash. Corresponding corrections to tail height and setting are also given. Author

N73-25006 Ministry of Aviation, London (England).
NUMERICAL METHODS FOR CALCULATING THE ZERO-LIFT WAVE DRAG AND THE LIFT-DEPENDENT WAVE DRAG OF SLENDER WINGS
J. Weber *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 155-173 refs Previously issued as RAE-Aero-2629; ARC-21890 (For availability see N73-24999 16-01)
(ARC-R/M-3221; RAE-Aero-2629; ARC-21890)

The evaluation of a double integral equation for calculating wave drag due to volume as well as lift is discussed. In many practical cases the function is not given in analytical form and the integration cannot be performed explicitly. The application of several numerical methods to the three different cases which represent the wave drag parameters is described. Mathematical models are developed to clarify the theoretical considerations.
Author

N73-25007 Ministry of Aviation, London (England).
SOME NOTES ON THE ZERO-LIFT WAVE DRAG OF SLENDER WINGS WITH UNSWEPT TRAILING EDGE
J. Weber *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 175-208 refs Previously issued as RAE-Aero-2630; ARC-21909 (For availability see N73-24999 16-01)
(ARC-R/M-3222; RAE-Aero-2630; ARC-21909)

Minimum values of the zero-lift wave drag of slender wings with certain fixed properties have been calculated by slender-body theory. The cross-sectional area distributions of the wings are taken to be polynominals and the fixed properties of the wings correspond to fixed first and second derivatives of the area distributions at the apex and rear end. The drag for delta wings of rhombic cross sections has also been calculated by thin-wing theory without the slenderness assumption. Comparisons between the drag coefficients calculated by both theories have been made for a series of wings to investigate the applicability of slender theory. The calculations by both theories suggest that it should be possible to design thickness distributions which have drags as low as that of the so-called Lord V area distribution is unsuitable. Further, this can be achieved when the thickness near the apex and the slope at the trailing edge are restricted. Author

N73-25008 Ministry of Supply, London (England).
DESIGN OF WARPED SLENDER WINGS WITH THE ATTACHMENT LINE ALONG THE LEADING EDGE
J. Weber *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 209-246 refs Supersedes RAE-TN-Aero-2530; ARC-20051 (For availability see N73-24999 16-01)
(ARC-R/M-3406; RAE-TN-Aero-2530; ARC-20051)

The design of slender warped wings with unswept trailing edge but otherwise arbitrary planform which have, at the design lift coefficient, zero load along the leading edge and a near planar vortex sheet from the trailing edge is discussed. The wing can have an arbitrary chordwise curvature on which a spanwise curvature is superposed so that in any spanwise section the wing is straight over the inner part of the wing and curved over

the portion near to the leading edges; the position of this change can vary arbitrarily in the chordwise direction. Formulas and working charts are given for determining the local load coefficient (and with it the streamwise velocity component), the spanwise velocity component, the total lift coefficient and the total drag. Numerical examples, for the gothic planform, are given to illustrate some of the effects of the various parameters on the load distribution, the section shapes and the drag. Slender-wing theory has been applied except for determining the wave drag. Author

N73-25009 National Physical Lab., Teddington (England).
MEASUREMENTS OF THE DIRECT PITCHING MOMENT DERIVATIVES FOR THREE WING PLANFORMS AT HIGH SUBSONIC SPEEDS
J. B. Bratt, W. G. Raymer, and J. E. G. Townsend *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 247-282 refs Supersedes ARC-16267 (For availability see N73-24999 16-01)
(ARC-R/M-3419; ARC-16267)

Wind tunnel measurements of the direct pitching damping and stiffness derivatives for a delta wing and two swept wing planforms are discussed. Results for the delta wing are compared with theoretical data. Experiments to investigate the cause of loss of damping at low frequencies are also investigated. The effect on derivative measurements of random oscillatory flow disturbances is examined. Author

N73-25010 Ministry of Aviation, London (England).
THE CALCULATION OF THE SPANWISE LOADING OF SWEPTBACK WINGS WITH FLAPS OR ALL-MOVING TIPS AT SUBSONIC SPEEDS
G. G. Brebner and D. A. Lemaire *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 283-323 refs Supersedes RAE-Aero-2553; ARC-18273 (For availability see N73-24999 16-01)
(ARC-R/M-3487; RAE-Aero-2553; ARC-18273)

Electric tank tests on wings of 45 deg sweepback with trailing edge flaps have been analyzed to provide the basis for a method of calculating the spanwise loading. The analysis yielded information about the effect of sweep on the equivalent incidence of a section with flap, on the downwash factor and on the spanwise loading distribution with an incidence discontinuity. Interpolation formulas are developed to extend the results to wings of any sweep and flap span, and thus a complete calculation method is presented for the spanwise loading with this type of control. The calculation method is tentatively extended to a wing with all-moving tip control. Author

N73-25011 Ministry of Aviation, London (England).
A WIND TUNNEL INVESTIGATION OF THE LONGITUDINAL AND LATERAL AERODYNAMIC CHARACTERISTICS OF A CANARD AIRCRAFT MODEL. PART 1: TESTS AT M EQUALS 1.04 AND M EQUALS 2.02. PART 2: TESTS AT M EQUALS 2.47
P. E. Watts, L. J. Beecham, and D. A. Treadgold *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 325-407 refs Previously issued as RAE-Aero-2575; RAE-Aero-2603; ARC-19218; ARC-20888 (For availability see N73-24999 16-01)
(ARC-R/M-3226; RAE-Aero-2575; RAE-Aero-2603; ARC-19218; ARC-20888)

Tests were made in a supersonic wind tunnel to measure the overall normal and side forces, rolling, pitching and yawing moments on a typical canard aircraft layout at M = 1.40 and M = 2.02. The complete configuration and configuration less fin, with foreplane angles, 0 deg and 10 deg were tested for combinations of incidence and sideslip up to 10 deg. Additional breakdown tests were made at M = 1.40, and supplemented by oil flow and vapour screen tests. The tests have shown that the foreplane has a reduced lifting, but an increased moment, effectiveness due to the download induced on the mainplane. The longitudinal stability increases with incidence and Mach number; neither normal force nor pitching moment is affected significantly by sideslip. The lateral and directional characteristics are less satisfactory. When sideslip is present the foreplane-wing interaction produces a large negative rolling moment which increases in magnitude with incidence and control setting. The tests indicate that further investigation is required into the effect of a free vortex on the load distribution over a lifting surface if satisfactory estimates are to be made of control-wing and control-fin interference. Author

N73-25012 Ministry of Aviation, London (England).
A WIND TUNNEL INVESTIGATION OF THE DIRECTIONAL AND LONGITUDINAL STABILITY OF THE JAVELIN AIRCRAFT AT TRANSONIC SPEEDS, INCLUDING COMPARISON WITH FLIGHT TEST RESULTS
E. P. Sutton and A. Stanbrook *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 409-462 refs Previously issued as RAE-TN-Aero-2563; RAE-Aero-2632; ARC-20582; ARC-22083 (For availability see N73-24999 16-01)
(ARC-R/M-3403; RAE-TN-Aero-2563; RAE-Aero-2632; ARC-20582; ARC-22083)

Directional and longitudinal stability measurements have been made on a 1/72 scale model of the Javelin aircraft at Mach numbers up to 1.12 in a 3 ft wind tunnel. Observations were made of the flow over the fin and the wing by the oil-flow technique. The results show directional instability near sonic speed, as observed in flight, due to shock-induced separation on the fin; this appears to have been caused by the wing trailing-edge shock wave, strengthened by the flow fields of the fin and rear fuselage. A small change in the shape of the rear fuselage delayed the separation to a higher wing incidence and eliminated the instability. For the model with the tail-on, the curves of pitching moment against normal force had stable slopes except near zero lift at isolated Mach numbers. The stability decreases at high incidence at M = 0.7 and at moderate incidences around M = 0.93. Flight and tunnel test results were in good qualitative agreement. The significant effect of a small distortion of the fuselage shape at the tail (such as might be made to accommodate a supporting sting) on directional stability is of general importance from the point of view of wind-tunnel testing. Author

N73-25013 Ministry of Supply, London (England).
THE GROWTH OF COMPRESSIBLE TURBULENT BOUNDARY LAYERS ON ISOTHERMAL AND ADIABATIC WALLS c12
D. A. Spence *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 463-477 refs (For availability see N73-24999 16-01)
(ARC-R/M-319; RAE-Aero-2619)

A mathematical model for the velocity profiles in the turbulent boundary layer on a flat plate at high Mach numbers is developed. The factors of wall, free stream, and recovery temperatures are the major parameters. Examples of mathematical relationships are provided for various temperature and pressure conditions. Author

N73-25014 Ministry of Supply, London (England).
AN AXIALLY SYMMETRIC ANALOGUE FOR GENERAL THREE DIMENSIONAL BOUNDARY LAYERS c12
J. C. Cooke *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 479-490 refs (For availability see N73-24999 16-01)
(ARC-R/M-3200; RAE-TN-Aero-2625)

The problem of calculating three-dimensional boundary layers is discussed. It is shown that the streamwise momentum equation, the energy equation, and the equation for continuity reduce to equations identical with those for flow over an axisymmetrical body, whose radius is determined from the local external flow. By solving these equations, it is possible to obtain approximate values for skin friction and the displacement surface for wings at small angles of incidence and no flow separation except at the edges. Author

N73-25015 Ministry of Supply, London (England).
APPROXIMATE CALCULATION OF THREE DIMENSIONAL LAMINAR BOUNDARY LAYERS c12
J. A. Cooke *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 491-520 refs (For availability see N73-24999 16-01)
(ARC-R/M-3201; RAE-TN-Aero-2658)

A test of three different approximate methods for solving the three-dimensional laminar boundary layer equations was

conducted using a problem whose solution is known. From the comparison, one of the methods is recommended as the one to use in general, provided that the cross flow in the boundary layer is not large. The method is tested on two allied problems whose exact solution is known and fair agreement is obtained. The three methods are used to find the angle between streamlines and limiting streamlines for the flow over a slender delta wing and to determine the point of separation. Author

N73-25016 National Physical Lab., Teddington (England). Aerodynamics Div.
THE DETERMINATION OF LOCAL TURBULENT SKIN FRICTION FROM OBSERVATIONS IN THE VISCOUS SUBLAYER c12
P. Bradshaw and N. Gregory *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 521-536 refs (For availability see N73-24999 16-01)
(ARC-R/M-3202)

Observations made in the viscous sub-layer of turbulent shear flows with small surface pitot-tubes and hot wires show that such instruments give accurate values of boundary-layer skin friction, at least in zero pressure gradient, but only when calibrated in turbulent flow. Calibration in laminar flow gives incorrect results by about 10 percent. It is further shown that the region of universality of turbulent velocity profile is confined to the viscous sub-layer, and an upper limit is suggested for the height of a flat surface tube if reasonable accuracy is to be obtained in skin-friction measurements. Author

N73-25017 Ministry of Supply, London (England).
THE CALCULATION OF THE COMPRESSIBLE TURBULENT BOUNDARY LAYER IN AN ARBITRARY PRESSURE GRADIENT: A CORRELATION OF CERTAIN PREVIOUS METHODS c12
B. S. Stratford and G. S. Beavers *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 537-556 refs Previously issued as NGTE-M-330; ARC-21399 (For availability see N73-24999 16-01)
(ARC-R/M-3207; NGTE-M-330; ARC-21399)

Several methods for calculating compressible turbulent boundary layer conditions are discussed. Mathematical models are developed to illustrate the methods used for various conditions of air flow. Comparisons are made of the results obtained by each of the methods discussed. Author

N73-25018 Aeronautical Research Council, London (England).
AN APPROXIMATE INTEGRAL METHOD FOR CALCULATING THE INCOMPRESSIBLE LAMINAR BOUNDARY LAYER ON AN INFINITE SWEPT WING ON WHICH VELOCITY AND SUCTION DISTRIBUTION ARE ARBITRARY c12
H. G. Pinsent and P. A. Pinsent *In its* Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 557-594 refs Previously issued as ARC-22154; RR-54 (For availability see N73-24999 16-01)
(ARC-R/M-3241; ARC-22154; RR-54)

An approximate solution for the cross-flow velocity in an incompressible laminar boundary layer on an infinite swept wing is described. The cross flow is defined as that velocity in the boundary layer in a direction normal to the outer flow streamline. The two-dimensional flow in the chordwise direction is assumed known. The boundary-layer equations are expressed in a non-dimensional form. Head's method, which is based on the momentum and energy equations and is used to solve the two-dimensional flow, is briefly described. From the non-dimensional boundary-layer equations, an equation involving the cross-flow profile directly is obtained. This equation is then integrated throughout the boundary layer giving two integral equations. Typical cross-flow shapes have been used to calculate functions which when used in conjunction with the two integral equations and the boundary condition at the wall enable the cross flow to be determined for arbitrary velocity and suction distributions. The stability criterion for three-dimensional flow is expressed in the notation of this method and is a simple condition on the cross flow. The method is then applied to the upper and lower surfaces of a wing, suction distributions being calculated to maintain stability at each point of the wing. For the lower surface comparison is made with an independent method in the adverse pressure-gradient region. Author

N73-25019 Aeronautical Research Council, London (England).
EXAMPLES OF THE EFFECTS OF SHOCK INDUCED BOUNDARY LAYER SEPARATION IN TRANSONIC FLIGHT c12
H. H. Pearcey and D. W. Holder *In its* Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 595-652 refs Supersedes ARC-16446 (For availability see N73-24999 16-01)
(ARC-R/M-3510; ARC-16446)

The effects of shock induced boundary layer separation in transonic flight are described. The variation of the pressure coefficient at the trailing edge of the wing has been used to deduce the onset of separation. The characteristics of boundary layer separation for swept and unswept wings are analyzed. Methods for eliminating or reducing the effects of boundary layer separation are proposed. The design of wing planforms to reduce shock induced separation at low angles of incidence is proposed. Author

N73-25020# Aeronautical Research Council, London (England).
[AERODYNAMIC RESEARCH PROGRESS, INCLUDING TURBINE, NOZZLE, FLUTTER, AND INSTRUMENTATION STUDIES, VOLUME 2] Technical Report, 1959
HMSO 1971 785 p refs
Avail: NTIS HC $41.25; HMSO £ 18; PHI $69.77

Research projects in theoretical and practical aerodynamics are presented. The subjects discussed are: (1) performance of highly loaded turbine stages, (2) subsonic derivatives for an oscillating wing, (3) pitching moment derivatives for two-dimensional flow at subsonic and supersonic speeds, (4) effects of transonic speed on wing-aileron flutter, (5) effects of wing stiffness and inertia changes on modes and frequencies of model delta wing aircraft, (6) loading of helicopter blades in forward flight, (7) performance of supersonic turbine nozzles, and (8) design of wing-body combinations of low zero-lift drag rise at transonic speeds. For individual titles, see N73-25021 through N73-25043.

N73-25021 Ministry of Aviation, London (England).
THE TEST PERFORMANCE OF HIGHLY LOADED TURBINE STAGES DESIGNED FOR HIGH PRESSURE RATIO c28
I. H. Johnston and D. C. Dransfield *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 653-682 refs Previously issued as NGTE-R-235; ARC-21245 (For availability see N73-25020 16-01)
(ARC-R/M-3242; NGTE-R-235; ARC-21245)

A blade design for a highly loaded two-stage turbine is described and the test performance of the turbine is presented. Some of the factors affecting the performance and matching of turbine blade rows operating at supersonic gas velocity are discussed and investigated by means of tests on a three-dimensional nozzle cascade tunnel and on a variety of single-stage turbine builds. Author

N73-25022 National Physical Lab., Teddington (England). Aerodynamics Div.
THEORETICAL SUBSONIC DERIVATIVES FOR AN OSCILLATING M-WING
H. C. Garner and W. E. A. Acum *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 683-709 refs Previously issued as ARC-20649 (For availability see N73-25020 16-01)
(ARC-R/M-3214; ARC-20649)

The aerodynamic characteristics of an oscillating half-wing model of an M-wing are discussed. As compared with conventional delta or arrowhead planforms, the M-wing has a high minimum pitching damping at low speeds, which occurs for a pitching axis close to the aerodynamic center. The comparison between calculated and measured values of the pitching derivatives is good for the in-phase lift and moment and somewhat less satisfactory for the damping derivatives. The symmetrical rigid bending mode is highly damped for the range of frequency parameter. Some calculations with an antisymmetrical rolling mode were made to estimate the corrections required. Author

N73-25023 Ministry of Supply, London (England).
THE VELOCITY POTENTIAL ON TRIANGULAR AND RELATED WINGS WITH SUBSONIC LEADING EDGES OSCILLATING HARMONICALLY IN SUPERSONIC FLOW
D. E. Davies *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 711-782 refs Previously issued as RAE-R-STRUCT-244; ARC-21185 (For availability see N73-25020 16-01)
(ARC-R/M-3229; RAE-R-STRUCT-244; ARC-21185)

A method for obtaining the velocity potential on a triangular wing with subsonic leading edges oscillating in a supersonic flow is presented. A symmetric mode of oscillation is considered which is represented by a polynomial expression in coordinates of the points of the wing. Mathematical models are included to support the theoretical concepts. Author

N73-25024 Ministry of Aviation, London (England).
A RECORD OF INFORMATION ON OSCILLATORY AERODYNAMIC DERIVATIVE MEASUREMENTS
H. Hall *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 783-861 refs Previously issued as RAE-TN-STRUCT-268; ARC-21595 (For availability see N73-25020 16-01)
(ARC-R/M-3232; RAE-TN-STRUCT-268; ARC-21595)

A survey of aerodynamic derivative measurements since 1940 is presented. The survey shows that measuring the main surface pitching moment derivatives has received the most attention. The parameter variations include details of Mach number, frequency parameter, Reynolds number, mean incidence, amplitudes of oscillation, and axis of oscillation. The axis of oscillation is defined as a distance aft of the leading edge for an unswept rectangular wing and a distance aft of the apex for a swept or delta wing. Author

N73-25025 National Physical Lab., Teddington (England).
MEASUREMENT OF PITCHING-MOMENT DERIVATIVES FOR AEROFOILS OSCILLATING IN TWO-DIMENSIONAL SUPERSONIC FLOW
C. Scruton, L. Woodgate, K. C. Lapworth, and J. Maybrey *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 863-897 refs Previously issued as ARC-20650 (For availability see N73-25020 16-01)
(ARC-R/M-3234; ARC-20650)

Pitching-moment derivatives have been measured by a free oscillation technique on two-dimensional airfoils of double wedge section with thickness/chord ratios of 0.08, 0.12 and 0.16; and on an airfoil of single wedge section of thickness/chord ratio 0.16. The Mach number ranged between 1.37 and 2.43 and the axis position was varied over a wide range. The Reynolds numbers and the frequency parameters of the tests were less than one million and 0.03 respectively. A few tests were made at incidence. For some axis positions and low values of Mach number, negative values of the aerodynamic damping were found considerably in excess of those predicted by theory. Theories which take into account thickness effects correctly predicted the trends of the derivatives with changes in axis position and in Mach number, and also the axis position at which the damping changes from positive to negative. However, substantial differences in the numerical values were often found, particularly at low Mach numbers and these are attributed in part to the detached bow-wave on the thicker wings at low Mach numbers and in part to the effects of the boundary layer and of flow separations. Author

N73-25026 Ministry of Aviation, London (England).
PART 1: A DESCRIPTION OF THE EXCITATION AND RECORDING EQUIPMENT USED FOR FLIGHT FLUTTER TESTS ON A METEOR 8. PART 2: COMPARATIVE FLIGHT FLUTTER TESTS USING THE DECAYING OSCILLATION AND AMPLITUDE RESPONSE TECHNIQUES c14
P. D. R. Luscombe and W. T. Kirkby *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 899-930 refs Previously issued as RAE-TN-STRUCT-252; ARC-21056; RAE-STRUCT-248; ARC-21158 (For availability see N73-25020 16-01)
(ARC-R/M-3247; RAE-TN-STRUCT-252; ARC-21056; RAE-R-STRUCT-248; ARC-21158)

A description is given of the installation of a single linear inertia exciter and multichannel recording equipment which was fitted to a Meteor aircraft for use in the development of flight flutter test techniques. The installation was designed so that either amplitude response or damping measurements could be made. Typical records and results are illustrated and the accuracy and capabilities of the equipment are assessed. Author

N73-25027 National Physical Lab., Teddington (England). Aerodynamics Div.
MEASUREMENTS OF THE DIRECT PITCHING-MOMENT DERIVATIVES FOR TWO-DIMENSIONAL FLOW AT SUBSONIC AND SUPERSONIC SPEEDS AND FOR A WING OF ASPECT RATIO 4 AT SUBSONIC SPEEDS
J. B. Bratt, W. G. Raymer, and J. E. G. Townsend *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 931-986 refs Previously issued as ARC-20714 (For availability see N73-25020 16-01)
(ARC-R/M-3257; ARC-20714)

Apparatus based on a self-excitation technique has been developed for the measurement of direct pitching-moment derivatives at high speeds, and has proved to function satisfactorily. Measurements have been made at subsonic speeds on a two-dimensional RAE 104 airfoil, both with and without spoilers, and on a rectangular wing of aspect ratio 4 with the same section; and at supersonic speeds (M = 1.42 and 1.61) on two-dimensional biconvex airfoils of 7.5 percent and 5 percent thickness. Comparisons with theory are made and discussed. Author

N73-25028 Ministry of Aviation, London (England).
SOME POSSIBLE EFFECTS OF TRANSONIC SPEEDS ON WING-AILERON FLUTTER
E. G. Broadbent and E. Violet Hartley *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 987-1000 refs Previously issued as RAE-TN-STRUCT-258; ARC-21055 (For availability see N73-25020 16-01)
(ARC-R/M-3258; RAE-TN-STRUCT-258; ARC-21055)

Ternary calculations between wing bending, wing torsion, and aileron rotation for a typical wing-aileron configuration were made. The results are plotted as graphs of flutter speed against aileron frequency and the effects of changes in aerodynamic derivatives such as might occur at transonic speeds. It was found that the derivative changes are first in direct aerodynamic damping on the aileron and then all stability derivatives and second an aft shift of wing aerodynamic center and aileron aerodynamic center, separately and together. Author

N73-25029 Ministry of Aviation, London (England).
A PROPOSED APPARATUS FOR MEASURING OSCILLATORY AERODYNAMIC DERIVATIVES c14
L. H. G. Sterne *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1001-1006 Previously issued as RAE-TN-Aero-2656; ARC-14227 (For availability see N73-25020 16-01)
(ARC-R/M-3260; RAE-TN-Aero-2656; ARC-14227)

The principles involved in designing an apparatus, including a half-model of an aircraft, for measuring longitudinal oscillatory aerodynamic derivatives in a high speed wind tunnel. The model is to be oscillated in pitch about two axes, one near the leading edge and one near the trailing edge. The use of a floating raft for measuring the alternating aerodynamic force on the model is discussed. Author

N73-25030 Aeronautical Research Council, London (England).
WIND TUNNEL TESTS AND THEORETICAL INVESTIGATIONS ON THE EFFECT OF A LOCALIZED MASS ON THE FLUTTER OF A DELTA WING WITH FIXED ROOT
G. F. Donno *In its* Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1007-1076 refs Previously issued as ARC-21234 (For availability see N73-25020 16-01)
(ARC-R/M-3264; ARC-21234)

Wind tunnel tests and theoretical investigations have been carried out to study the effect of a localized mass on the flutter characteristics of a delta wing. The experimental work covered

a wide range of spanwise and chordwise positions of the mass c.g., variation of the magnitude and radius of gyration of the mass itself, and the effect of the stiffness distribution of the wing. The theoretical work was more limited in its scope and was primarily intended to investigate the reliability of the theoretical approach to this kind of problem. These investigations have shown that the flutter characteristics of a delta wing carrying a localized mass are primarily dependent on the location of the mass, its magnitude and the stiffness distribution of the wing itself. The flutter speed with a localized mass judiciously placed may be from three to four times that obtained with the same mass in a bad position. A localized mass in the region around the structural axis generally has an adverse effect on the flutter characteristics, while locations well aft, towards the trailing edge, are usually favourable. Particularly high flutter speeds are often associated with a localized mass close to the leading edge, but some caution is necessary, especially around the mid-span position, as the flutter characteristics in this region are very sensitive to variations in actual mass. Author

N73-25031 Ministry of Supply, London (England).
EFFECTS OF WING STIFFNESS AND INERTIA CHANGES ON THE MODES AND FREQUENCIES OF MODEL DELTA AIRCRAFT c02
D. R. B. Webb *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1077-1092 refs Previously issued as RAE-STRUCT-245; ARC-21290 (For availability see N73-25020 16-01)
(ARC-R/M-3268; RAE-R-STRUCT-245; ARC-21290)

Resonance tests were made on a model delta aircraft to investigate the effect of stiffness changes of the leading- and trailing-edge spars on the frequencies and modes of vibration of the model. The results showed that, although considerable frequency changes were apparent, the general shape of the modes of vibration did not change significantly. A criterion of modal orthogonality proved to be very useful in checking the purity of the modes. Author

N73-25032 Ministry of Aviation, London (England).
THE LOADING OF HELICOPTER ROTOR BLADES IN FORWARD FLIGHT c02
M. A. P. Willmer *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1093-1136 refs Supersedes RAE-NAVAL-2; ARC-21233 (For availability see N73-25020 16-01)
(ARC-R/M-3318; RAE-R-NAVAL-2; ARC-21233)

A method is described for calculating the spanwise loading of helicopter rotor blades in forward flight at various azimuth angles. The method is an extension of Glauert's lifting-line theory. The problem is reduced to solving a series of simultaneous linear equations and the computations were performed by an electronic digital computer. Theoretical results obtained by this method for tip speed ratios of 0.08, 0.15 and 0.29 show considerably better agreement with experimental results than that obtained by previous methods. The report also shows how the theory may be used to calculate the vertical forces transmitted by the blades to the rotor hub. Author

N73-25033 Manchester Univ. (England). Dept. of the Mechanics of Fluids.
WAVE THEORY OF THE MACH-ZEHNDER INTERFEROMETER c14
H. K. Zienkiewicz *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1137-1158 refs (For availability see N73-25020 16-01)
(ARC-R/M-3173)

A theory of the Mach-Zehnder interferometer is developed using the approach of investigating the history of a wave front produced by an element of an extended light source. Account is taken of the effects of imperfections of the optical components including all the first-order aberrations of the collimating and collecting lenses or mirrors and of the camera lens. The theory can also be applied to other two-beam interferometers. Author

N73-25034 National Physical Lab., Teddington (England). Aerodynamics Div.
THE NORMAL IMPINGEMENT OF A CIRCULAR AIR JET ON A FLAT SURFACE c12
P. Bradshaw and Edna M. Love *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1159-1166 refs Previously issued as ARC-21268 (For availability see N73-25020 16-01)
(ARC-R/M-3205; ARC-21268)

Measurements of velocity magnitude and direction, static pressure, and skin friction have been made in a circular turbulent jet impinging normally on a flat surface. The speed in the jet just before impingement was 135 ft/sec and its radius was about 2.5 in. The region of increased static pressure near the stagnation point is roughly hemispherical, with a radius slightly larger than that of the jet. The maximum value of skin friction occurs at a radius approximately equal to that of the jet and is about 0.006 of the jet maximum dynamic pressure at the test Reynolds number. The virtual origin of the resulting radial wall jet is very close to the stagnation point. Author

N73-25035 Ministry of Aviation, London (England).
A THEORETICAL STUDY OF ANNULAR SUPERSONIC NOZZLES c12
W. T. Lord *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1167-1196 Previously issued as RAE-Aero-2627; ARC-21706 (For availability see N73-25020 16-01)
(ARC-R/M-3227; RAE-Aero-2627; ARC-21706)

The design of annular supersonic nozzles to produce uniform flow in supersonic wind tunnels which are axisymmetrical and which have an internal coaxial circular cylinder is discussed. Symmetrical two-dimensional and conventional axisymmetrical nozzles are special cases of annular nozzles. Proposals are made for design criteria sufficient to ensure that the flow inside a nozzle is free from limit lines and shock waves. The two procedures for designing two-dimensional and axisymmetrical nozzles are generalized to apply to annular nozzles. One of the design procedures is mainly analytical and the other is mainly numerical. The analytical expressions in both procedures are made much more complicated by the presence of the internal cylinder but the numerical process (the method of characteristics) is not. The design criteria and the mainly numerical design procedure are successfully applied to the design of a particular annular nozzle. Author

N73-25036 Ministry of Aviation, London (England).
ON AXISYMMETRICAL GAS JETS, WITH APPLICATION TO ROCKET JET FLOW FIELDS AT HIGH ALTITUDES c12
W. T. Lord *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1197-1224 refs Previously issued as RAE-Aero-2626; ARC-21535 (For availability see N73-25020 16-01)
(ARC-R/M-3235; RAE-Aero-2626; ARC-21535)

A study is made of some existing analytical, numerical and experimental results for gas jets expanding out of axisymmetrical nozzles. Jets expanding into a vacuum and into still air at finite pressure are considered in detail, and by introducing certain new ideas the existing results are expressed in a compact form and thereby rendered more widely applicable. A brief examination of jets expanding into supersonic air streams suggests that some information about the flow fields of rocket jets at high altitudes may be deduced from the extended results for still-air in which the reference pressure at the nozzle exit is much greater than the ambient pressure; an example for a particular rocket and a specific trajectory is given. Author

N73-25037 Ministry of Aviation, London (England).
THE PERFORMANCE OF SUPERSONIC TURBINE NOZZLES c12
B. S. Stratford and G. E. Sansome *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1225-1257 refs Previously issued as NGTE-R-234; ARC-21261 (For availability see N73-25020 16-01)
(ARC-R/M-3273; NGTE-R-234; ARC-21261)

An investigation has been conducted into the performance of turbines having high pressure ratios per stage. The mode of operation of supersonic nozzles for such turbines, and a cascade experiment are described. Both theory and experiment demonstrate that the conditions imposed upon the supersonic

flow immediately downstream of the nozzles exert an overriding influence upon the nozzle outlet flow angle, and hence upon the maximum pressure ratio obtainable across the nozzle--providing that the axial component of velocity is subsonic. This is an important difference from the more familiar flow of subsonic turbine nozzles, where, for example, the downstream gas angle is controlled predominantly by the nozzle blade shape and spacing. A suitable test technique using a closed-jet tunnel is demonstrated. Author

N73-25038 Manchester Univ. (England). Dept. of the Mechanics of Fluids.
FURTHER RESULTS ON THE MIXING OF FREE AXIALLY-SYMMETRICAL JETS OF MACH NUMBER 1.40 c12
N. H. Johannesen *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1259-1285 refs Previously issued as ARC-20981 (For availability see N73-25020 16-01)
(ARC-R/M-3292; ARC-20981)

An axially-symmetrical supersonic fully-expanded jet of diameter 0.75 in. was investigated by pitot- and static-tube traverses in the region from the exit to 100 diameters downstream. In the jet discussed in this report the initial internal disturbances were weak, as compared with those in the jet investigated previously. The structures of the mixing regions in the initial parts of the two jets showed substantial differences. Further downstream the jet with weak internal disturbances showed a very slow approach to self-preserving flow. The ratio of static pressure to dynamic pressure showed no tendency to become constant on the axis, even at the last station of measurement. The relation between the static-pressure distributions and the jet turbulence is discussed and it is shown that if the classical corrections to the readings of pitot and static tubes are adequate the errors in the deduced structure of the jet, ignoring these corrections, may be very considerable. Author

N73-25039 Ministry of Aviation, London (England).
PRINCIPLES OF ATTITUDE CONTROL OF ARTIFICIAL SATELLITES c21
N. E. Ives *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1287-1307 Previously issued as RAE-TN-GW-534; ARC-21963 (For availability see N73-25020 16-01)
(ARC-R/M-3276; RAE-TN-GW-534; ARC-21963)

The equations of attitude motion are derived for small angular displacements from the equilibrium position of an earth-pointing satellite employing reaction-flywheel damping. This is followed by a discussion on the attitude control of a space-stabilized satellite, with particular reference to attitude control against the gravitational torque due to the earth and the use of reaction-jets for the control of a spherical satellite configuration; finally a single-plane analytical account is given, of a method of eliminating any undesirable angular momentum which the satellite may possess immediately it leaves the carrier missile for its future orbit. Author

N73-25040 Ministry of Supply, London (England).
THE BUCKLING OF A PRESSURIZED STIFFENED CYLINDER UNDER AXIAL LOAD c32
K. I. McKenzie *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1309-1324 refs (For availability see N73-25020 16-01)
(ARC-R/M-3198; RAE-R-STRUCT-247)

An analysis is made of the general buckling of a pressurized stiffened cylinder under axial load. Torsional buckling of the complete cylinder, local buckling of the stringers and pure compressive failure of the stringers are also considered, and the design of stiffened pressurized cylinders is discussed, with an example. Author

N73-25041 Ministry of Supply, London (England).
CALCULATION OF FLEXIBLE WALL SHAPES AND PREPARATION OF CONTROL TAPES FOR THE BEDFORD 8-FT BY 8-FT WIND TUNNEL c11
Marjorie M. Barritt and K. V. Diprose *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1325-1357 refs (For availability see N73-25020 16-01)
(ARC-R/M-3187; RAE-R-MS-54)

An application of a digital computer to the aerodynamic design and automatic control of a large wind tunnel with flexible walls is described. The computational problem was threefold: first, calculation of the wall shapes for a set of pivotal operating speeds between M = 1 and 2.8; second, computation of the necessary movements of the set of screw jacks which flex the walls; and finally, preparation of the set of digitally punched control tapes. A new mathematical approach was used for the first part in order to avoid singularities in the partial differential equations governing the flow in the convergent-divergent nozzle of the tunnel. Author

N73-25042 Ministry of Aviation, London (England).
THE EFFECT OF HUMIDITY ON LAMINAR RECOVERY TEMPERATURE MEASUREMENTS IN SUPERSONIC FLOW OF AIR IN WIND TUNNELS c12
J. F. W. Crane *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1359-1380 refs Previously issued as RAE-Aero-2616; ARC-21822 (For availability see N73-25020 16-01)
(ARC-R/M-3215; RAE-Aero-2616; ARC-21822)

Wind-tunnel tests have been made at a Mach number of 2.92 to measure the effect of humidity on laminar recovery temperature on a cone. Its effect is to increase the recovery temperature above that obtained with dry air. Consideration of the latent heat addition to the air in the condensation shock allows a theoretical estimate of recovery temperature to be made, based on true total temperature and true Mach number. The results agree with theory and support assumptions of no re-evaporation in the boundary layer and no change in recovery factor. It is suggested that a device for the continuous measurement of laminar recovery temperature would provide a simple monitor of the degree of condensation in wind tunnels. Author

N73-25043 Ministry of Aviation, London (England).
ON THE DESIGN OF WING-BODY COMBINATIONS OF LOW ZERO-LIFT DRAG RISE AT TRANSONIC SPEEDS
W. T. Lord *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1381-1426 refs Previously issued as ARC-22503 (For availability see N73-25020 16-01)
(ARC-R/M-3279; ARC-22503)

The design of wing-body combinations of low zero-lift drag rise at transonic speeds is discussed. The use of the sonic area rule to obtain the desired design parameters is analyzed. Results for several optimum area distributions for minimum drag jump are given, specific examples of the optimum wing-body design are included. Author

N73-25044# Technion - Israel Inst. of Tech., Haifa. Aeronautical Research Center.
WIND TUNNEL MEASUREMENTS OF THE BASE PRESSURE OF AN AXIALLY SYMMETRIC MODEL IN SUBSONIC, TRANSONIC AND SUPERSONIC SPEEDS AT HIGH REYNOLDS NUMBERS
J. Rom, M. Victor, M. Reichenberg, and M. Salomon Jul. 1972 34 p refs Presented at 38th Semiann. Supersonic Tunnel Assoc. Meeting, San Diego, Calif., 11-12 Sep. 1972
(TAE-134) Avail: NTIS HC $3.75

Base pressures are measured on various sting supported and side supported ogive cylinder models. The models are tested at Mach numbers between 0.4 to 2.5 (including the transonic range) and at Reynolds numbers based on models length of 3 x 1 million to 2 x 10 to the 7th power. In the supersonic range there seems to be good agreement with available data. At the subsonic speeds, the base pressure measurements indicate a strong effect of the sting support. An irregular variation of base pressure is obtained under certain conditions at transonic speeds - the transonic well variation. The present data suggests that this behavior appears when the transonic peak is delayed to sonic or above sonic speeds. Author

N73-25045*# Aerophysics Research Corp., Bellevue, Wash.
AN IMPROVED METHOD FOR THE AERODYNAMIC ANALYSIS OF WING-BODY-TAIL CONFIGURATIONS IN

SUBSONIC AND SUPERSONIC FLOW. PART 1: THEORY AND APPLICATION

F. A. Woodward Washington NASA May 1973 129 p refs 2 Vol.

(Contract NAS1-10408)

(NASA-CR-2228-Pt-1) Avail: NTIS HC $3.00 CSCL 01C

A new method has been developed for calculating the pressure distribution and aerodynamic characteristics of wing-body-tail combinations in subsonic and supersonic potential flow. A computer program has been developed to perform the numerical calculations. The configuration surface is subdivided into a large number of panels, each of which contains an aerodynamic singularity distribution. A constant source distribution is used on the body panels, and a vortex distribution having a linear variation in the streamwise direction is used on the wing and tail panels. The normal components of velocity induced at specified control points by each singularity distribution are calculated and make up the coefficients of a system of linear equations relating the strengths of the singularities to the magnitude of the normal velocities. The singularity strengths which satisfy the boundary condition of tangential flow at the control points for a given Mach number and angle of attack are determined by solving this system of equations using an interactive procedure. Once the singularity strengths are known, the pressure coefficients are calculated, and the forces and moments acting on the configuration determined by numerical integration. Author

N73-25046*# Aerophysics Research Corp., Bellevue, Wash.

AN IMPROVED METHOD FOR THE AERODYNAMIC ANALYSIS OF WING-BODY-TAIL CONFIGURATIONS IN SUBSONIC AND SUPERSONIC FLOW. PART 2: COMPUTER PROGRAM DESCRIPTION

F. A. Woodward Washington NASA May 1973 316 p ref 2 Vol.

(Contract NAS1-10408)

(NASA-CR-2228-Pt-2) Avail: NTIS HC $6.00 CSCL 01C

For abstract, see N73-25045

N73-25047*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF A VECTORED-THRUST V/STOL FIGHTER IN THE TRANSITION SPEED RANGE

Raymond E. Mineck (Army Air Mobility R and D Lab., Hampton, Va.) and Myles F. Schwendemann (Northrop Corp., Hawthorne, Calif.) Washington May 1973 181 p refs

(NASA-TN-D-7191; L-8457) Avail: NTIS HC $3.00 CSCL 01C

A wind-tunnel investigation was conducted with a vectored-thrust V/STOL fighter configuration. The model was equipped with two nacelle-mounted vectored-thrust jet simulators and one lift-jet simulator. The vectored-thrust jet could be tested at two alternate longitudinal positions and three nozzle deflection angles. The vectored-thrust configuration with the rear nozzles showed an increase in lift and a decrease in pitching moment when compared with the forward nozzles. The rear nozzles also improve stall characteristics. Author

N73-25048*# Nielsen Engineering and Research, Inc., Mountain View, Calif.

DEVELOPMENT OF A NONLINEAR UNSTEADY TRANSONIC FLOW THEORY

Stephen S. Stahara and John R. Spreiter (Stanford Univ., Calif.) Washington NASA Jun. 1973 47 p refs

(Contract NAS1-11567)

(NASA-CR-2258; NEAR-TR-46) Avail: NTIS HC $3.00 CSCL 20D

A nonlinear, unsteady, small-disturbance theory capable of predicting inviscid transonic flows about aerodynamic configurations undergoing both rigid body and elastic oscillations was developed. The theory is based on the concept of dividing the flow into steady and unsteady components and then solving, by method of local linearization, the coupled differential equation for unsteady surface pressure distribution. The equations, valid at all frequencies, were derived for two-dimensional flows, numerical results, were obtained for two classses of airfoils and two types of oscillatory motions. Author

N73-25049*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

FLIGHT-MEASURED X-24A LIFTING BODY CONTROL SURFACE HINGE MOMENTS AND CORRELATION WITH WIND TUNNEL PREDICTIONS

Ming H. Tang and George P. E. Pearson Washington Jun. 1973 38 p refs

(NASA-TM-X-2816; H-748) Avail: NTIS HC $3.00 CSCL 01B

Control-surface hinge-moment measurements obtained in the X-24A lifting body flight-test program are compared with results from wind-tunnel tests. The effects of variations in angle of attack, angle of sideslip, rudder bias, rudder deflection, upper-flap deflection, lower-flap deflection, Mach number, and rocket-engine operation on the control-surface hinge moments are presented. In-flight motion pictures of tufts attached to the inboard side of the right fin and the rudder and upper-flap surfaces are discussed. Author

N73-25050# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Antriebssysteme.

EVALUATION OF THE THERMOGASDYNAMIC CORRELATION BETWEEN SHOCK ANGLE AND HEAT ADDITION WITHIN AN OBLIQUE SHOCK [ZUR ERMITTLUNG DES THERMOGASDYNAMISCHEN ZUSAMMENHANGS ZWISCHEN STOSSFRONTWINKEL UND WAERMEZUFUHR IM SCHRAEGEN VERDICHTUNGSSTOSS]

Norbert Schmidt and Michael Kallergis 1973 46 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-21) Avail: NTIS HC $4.50; DFVLR, Porz: 11.50 DM

The effects of heat addition within an oblique shock on the thermodynamic, gasdynamic, and geometric properties were evaluated, and the results presented by graphs for different parameters. Method is presented for determining the implicit given shock angle for existing flow Mach number, heat input, and streamline deflection. In a synoptic the range of physically possible sets of parameter values is shown graph. Limiting lines divide the whole field into regions of strong and weak solutions for the density jump and into regions of the weak and the strong shock. Author (ESRO)

N73-25051# Aeronautical Research Inst. of Sweden, Stockholm.

DISK APPROXIMATION FOR A HELICOPTER ROTOR IN FORWARD FLIGHT

Bo C. A. Johansson Jul. 1972 66 p refs Sponsored in part by Swed. Board for Tech. Develop.

(FFA-123) Avail: NTIS HC $5.50; Almqvist and Wiksell, Stockholm Sw.Kr. 35

A theory for calculating the induced velocity distribution of a helicopter rotor in forward flight was developed. The rotor is approximated by an actuator disk of continuous thrust and in-plane force distributions, which are assumed to be known. Its wake is represented by a semi-infinite cylinder of distributed vorticity. Also suggested is a method of using this theory to solve the full rotor problem, when the inflow data are given but the force distribution is unknown. A numerical example applied to a rotor with blades without torsion and with constant chord is calculated. ESRO

N73-25052# ARO, Inc., Arnold Air Force Station, Tenn.

AERODYNAMIC CHARACTERISTICS OF TWO BODIES OF REVOLUTION WITH NOSES OF VARYING SPHERICAL BLUNTNESS AT MACH NUMBERS FROM 0.6 TO 1.5 Final Report

E. G. Allee, Jr. AEDC Apr. 1973 52 p ref

(AF Proj. 2547; ARO Proj. PA278)

(AD-758817; ARO-PWT-TR-73-9; AEDC-TR-73-44; AFATL-TR-73-50) Avail: NTIS CSCL 16/4

A wind tunnel investigation was conducted to determine the static stability characteristics of two bodies of revolution fitted with 2-, 3-, and 4-cal tangent ogive noses of varying spherical bluntness. Testing was conducted at Mach numbers from 0.6 to 1.5 and angles of attack from -2 to 14 deg. The major effect of blunting the noses was evidenced in the axial-force coefficient. Lengthening the noses from 2 to 4 cal caused a

forward movement of the center-of-pressure location and a corresponding decrease in axial-force coefficient at Mach numbers of 1.0 and higher. Changing from a 5- to a 9-cal midbody resulted in an increase in axial-force coefficient and an aft movement of the center-of-pressure location. Author (GRA)

N73-25053# ARO, Inc., Arnold Air Force Station, Tenn.
WIND TUNNEL INVESTIGATION OF THE PRESSURE DISTRIBUTION ON A TWO DIMENSIONAL AIRFOIL WITH PYLON MOUNTED STORES AT MACH NUMBERS FROM 0.7 TO 0.95 Final Report
D. K. Smith AEDC Apr. 1973 145 p
(AD-759582; ARO-PWT-TR-73-27; AEDC-TR-73-71; AFATL-TR-73-75) Avail: NTIS CSCL 20/4

A wind tunnel test was conducted to determine pressure distributions on a two-dimensional airfoil with pylon-mounted stores at Mach numbers from 0.70 to 0.95 and angles of attack from 0 to 14 deg. Four geometrically similar pylon-mounted stores differing in diameter by a factor of about four and four pylons differing in height were tested. Pressure distributions on the airfoil were obtained for the clean airfoil configuration and 12 pylon/store combinations. The pressure distributions were integrated and the lift, drag, and pitching-moment coefficients for the airfoil are presented. Total pressure wake surveys and oil flow photographs were also obtained for the test, and typical data are presented. Author (GRA)

N73-25054# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
WEIGHT OPTIMIZATION OF SOLID BEAMS WITH DYNAMIC CONSTRAINTS M.S. Thesis
Floyd W. Isley Mar. 1973 74 p refs
(AD-759169; GAW/MC/73-9) Avail: NTIS CSCL 01/3

The mass distribution of solid beams and panels is optimized to produce a weight savings while maintaining a dynamic constraint. The basic procedure used in solving the problems is the transition matrix method, a numerical technique of optimization adapted from optimal control theory. The weight of a solid beam of rectangular cross section is shown to be reduced from that of a beam of uniform thickness by ten percent. The weight savings was accomplished by varying the thickness while insuring that the beam with the optimal thickness had the same fundamental frequency as the beam of uniform thickness. (Author Modified Abstract) GRA

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-25055 Purdue Univ., Lafayette, Ind.
A SIMULATION OF A LINEAR OPTIMAL DIGITAL AUTOPILOT CONTROLLING A STOL AIRCRAFT Ph.D. Thesis
Franklin DeLoe Farrington 1972 188 p
Avail: Univ. Microfilms Order No. 72-30891

An air traffic control scheme is developed which allows airport landing patterns along curved approach trajectories. The particular problems attacked are the required data to be transmitted from ground control to the aircraft, the type of curved trajectory feasible, and the on-board control system requirements for accurate maintenance of prescribed trajectories during adverse weather conditions. The data requirements are developed, the curved approach proposed is a sequence of straight lines and circular arcs with the three spatial dimensions and time specified at each point of tangency, and the control system is a digital realization of a linear optimal estimator and controller.
Dissert. Abstr.

N73-25056 Colorado State Univ., Fort Collins.
MINIMIZATION OF TIME OF DETECTION OF THE EFFECT OF WEATHER MODIFICATION Ph.D. Thesis
Fariborz Peydaye Saheli 1972 128 p
Avail: Univ. Microfilms Order No. 72-31338

The best combination of stations in the San Juan Mountains to detect, in minimum time, an increase in the mean seasonal runoff due to cloud seeding was investigated. The number of years, N, which is required for detection is derived from statistical hypothesis testing. By considering weighted linear combinations of runoff stations in the San Juan Mountains and in an adjacent region which will not be affected by cloud seeding, N, the number of years, in minimized by finding the optimal weight factors. Minimization of N is performed by a numerical optimization technique, referred to in the literature as the Different Algorithm. Dissert. Abstr.

N73-25057*# Kanner (Leo) Associates, Redwood City, Calif.
COMFORTABLE TRAVEL ON 11 'COUNTRY ROUTES'
K. H. Eyermann Washington NASA Jun. 1973 17 p Transl. into ENGLISH from Tech.-Okonomische Inform. Zivilen Luftfahrt (West Germany), v. 8, no. 8, 1972 p 356-363 Sponsored by NASA
(NASA-TT-F-14943) Avail: NTIS HC $3.00 CSCL 01C

The Yak-40 - a short-haul (865-1600 km), twin-jet aircraft designed particularly for service in isolated areas of the U.S.S.R. and capable of landing on small airfields without concrete runways, is discussed. The Yak-40 features bypass jet turbines, rear-mounted engines, and a T tail section coupled with the conventional large-aspect-ratio delta wing, all-surface landing gear, and ease of maintenance of the Li-2 and Il-14 propeller aircraft which it replaces. The Yak-40 can take off from airstrips only 340-360 meters long, has takeoff and landing speeds of 160 and 150 km/hr, respectively, and has fast climbing ability. The Yak-40 is equipped with all the instrumentation required for allweather flight, including an onboard computer and radar with a range of up to 350 km. Author

N73-25058# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
RATIONAL CALCULATION OF DESIGN GUST LOADS IN RELATION TO PRESENT AND PROPOSED AIRWORTHINESS REQUIREMENTS
J. Yff [1972] 13 p refs Presented at AGARD Symp. Flight in Turbulence, Bedfordshire, Engl.
(Fok-K66) Avail: NTIS HC $3.00

Accurate gust load calcuations for three short haul aircraft were used to compare: (1) PSD are discrete gust methods, (2) PSD mission analysis and design envelope results, and (3) PSD results for vertical and lateral gusts. These data are also used to study in detail problems of T-tails. Author

N73-25059# Cranfield Inst. of Technology (England).
A PERFORMANCE TEST SURVEY OF THE AERODYNAMIC DEVELOPMENT OF THE SLINGSBY T51 DART SAILPLANE
H. A. Torode Feb. 1973 21 p refs
(Cranfield-Aero-16) Avail: NTIS HC $3.25

Comparison is drawn between performance test data gathered from several variants of the Slingsby T51 Dart sailplane as tested during 1964/5 and also from other contemporary sources. In each case an identical statistical approach has been used in the data analysis. The data shows excellent correllation both between the aerodynamic variants tested and also between the Cranfield tests and those from elsewhere, and has enabled useful conclusions on the aerodynamic development of the Dart to be drawn. Performance testing is considered to be economic means whereby a manufacturer may monitor the development of his product. Author

N73-25060# Cranfield Inst. of Technology (England). Structural and Aerospace Dynamics Group.
ANALYSIS OF TAXIING INDUCED VIBRATIONS IN AIRCRAFT BY THE POWER SPECTRAL DENSITY METHOD.
C. L. Kirk Feb. 1973 38 p refs
(Contract F44620-71-C-0084)
(Cranfield-Aero-15) Avail: NTIS HC $4.00

The root mean square (r.m.s.) center of gravity accelerations and undercarriage forces are determined for a KC-135 tank-

aircraft taxiing on a randomly rough runway surface at various speeds up to 260 ft/sec. The maximum r.m.s. acceleration was found to be 0.32g at a taxiing speed of 210 ft/sec. Tire deformations were found to be of the order of 0.6 in r.m.s., and strut displacements were about 0.34 in r.m.s. The maximum forces in the tires and struts were found to be almost identical and equal to about 10% of the static load on the main undercarriage. Author

N73-25061# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Manufacturing Research and Product Development Dept.

ADHESIVE BONDING IN THE FOKKER-VFW F-28 FELLOWSHIP

Rob J. Schliekelmann Feb. 1973 15 p

Avail: NTIS HC $3.00

The various design aspects of the adhesive bonding components, as well as the adhesive bonding processes and quality control methods used in constructing the Fokker F-28 Fellowship aircraft are given. The F-28 is designed for economical short haul operations and must have the following structural characteristics: (1) long crack free life, (2) fail safe design, (3) high durability under severe operational conditions, and (4) ample accessability for inspection of the structure and its installations. E.H.W.

N73-25062*# Battelle Columbus Labs., Ohio.

EFFECTIVENESS EVALUATION OF STOL TRANSPORT OPERATIONS Final Report

Ellis F. Hitt, Juergen M. H. Bruckner, Vincent J. Drago, Ronald A. Brown, Fred G. Rea, and Richard F. Porter 20 Feb. 1973 296 p refs

(Contract NAS2-6889)

(NASA-CR-114631) Avail: NTIS HC $17.00 CSCL 01C

A short-takeoff and landing (STOL) systems simulation model has been developed and implemented in a computer code (known as STOL OPS) which permits evaluation of the operation of a STOL aircraft and its avionics in a commercial airline operating environment. STOL OPS concentrated on the avionics functions of navigation, guidance, control, communication, hazard avoidance, and systems management. External world factors influencing the operation of the STOL aircraft include each airport and its geometry, air traffic at each airport, air traffic control equipment and procedures, weather (including winds and visibility), and the flight path between each airport served by the route. The development of the STOL OPS program provides NASA a set of computer programs which can be used for detailed analysis of a STOL aircraft and its avionics and permit establishment of system requirements as a function of airline mission performance goals. Author

N73-25063*# Case Western Reserve Univ., Cleveland, Ohio. School of Engineering.

AUTOMATED DESIGN OPTIMIZATION OF SUPERSONIC AIRPLANE WING STRUCTURES UNDER DYNAMIC CONSTRAINTS

Richard L. Fox, Hirokazu Miura (Tech. Univ. of Norway), and Singiresu S. Rao (Indian Inst. of Tech.) Oct. 1972 20 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Aircraft in June 1973

(Grant NGR-36-003-002)

(NASA-CR-112319) Avail: NTIS HC $3.00 CSCL 01C

The problems of the preliminary and first level detail design of supersonic aircraft wings are stated as mathematical programs and solved using automated optimum design techniques. The problem is approached in two phases: the first is a simplified equivalent plate model in which the envelope, planform and structural parameters are varied to produce a design, the second is a finite element model with fixed configuration in which the material distribution is varied. Constraints include flutter, aeroelastically computed stresses and deflections, natural frequency and a variety of geometric limitations. Author

N73-25064# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT US CIVIL AVIATION, ISSUE NO. 2 OF 1972 ACCIDENTS

3 Apr. 1973 518 p

(NTSB-BA-73-3) Avail: NTIS HC $28.00

Selected aircraft accident reports, in brief format, occurring in U.S. Civil Aviation operations during calendar year 1972 are presented. The 899 General Aviation accidents contained in this publication represent a random selection. This publication is issued irregularly, normally six times each year. The brief format presents the facts, conditions, circumstances, and probable causes for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N73-25065*# Lockheed-California Co., Burbank.

QUIET TURBOFAN STOL AIRCRAFT FOR SHORT HAUL TRANSPORTATION, VOLUME 1 Final Report

J. H. Renshaw 14 Jun. 1973 690 p refs 2 Vol.

(Contract NAS2-6995)

(NASA-CR-114612) Avail: NTIS HC $36.25 CSCL 01C

The characteristics for a quiet turbofan short takeoff aircraft for short haul transportation applications are discussed. The following subjects are examined: (1) representative aircraft configurations, characteristics, and costs associated with the short haul aircraft development and operation, (2) critical technology and technology related problems to be resolved in successful introduction of representative short haul aircraft, (3) relationships between quiet short takeoff aircraft and the economic and social viability of short haul, and (4) identification of high payoff technology areas. In order to properly evaluate the candidate aircraft designs and to determine their economic viability and community acceptance, a real world scenario was developed and projected to 1990. Author

N73-25066*# Lockheed-California Co., Burbank.

QUIET TURBOFAN STOL AIRCRAFT FOR SHORT HAUL TRANSPORTATION, VOLUME 2 Final Report

J. H. Renshaw 14 Jun. 1973 655 p refs 2 Vol.

(Contract NAS2-6995)

(NASA-CR-114613) Avail: NTIS HC $34.75 CSCL 01C

For abstract, see N73-25065

N73-25067*# Scripta Technica, Inc., Washington, D.C.

GRID PLANNING AND MANAGEMENT IN AIR TRANSPORT

A. V. Miroshnikov, A. S. Kravets, and A. N. Zhizhnyak NASA May 1973 119 p refs Transl. into ENGLISH of the book "Setevoye Planirovaniye i Upravleniye na Vozdushnom Transporte" Moscow, Transport Press, 1971 112 p

(Contract NASw-2036)

(NASA-TT-F-742) Avail: NTIS HC $3.00 CSCL 05C

The essentials, importance, range of application, and advantages of grid planning and management (U.S. usage: PERT (Program Evaluation and Review Technique)) systems as applied to air transport are presented. The basic concepts of the grid planning and management system are set forth and the rules for construction of various types of grid diagrams (U.S. usage: critical diagrams or PERT charts) and the procedure for calculation of their parameters are described. Methods of optimizing grid models and operations-management methods in work from grid diagrams in civil aviation are reported. Author

N73-25068*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND TUNNEL INVESTIGATION OF STATIC LONGITUDINAL AND LATERAL CHARACTERISTICS OF A FULL SCALE MOCKUP OF A LIGHT SINGLE ENGINE HIGH WING AIRPLANE

H. Douglas Greer, James P. Shivers, Marvin P. Fink, and C. Robert Carter (Army Air Mobility Res. and Develop. Lab.) Washington May 1973 158 p refs

(NASA-TN-D-7149; L-8682) Avail: NTIS HC $3.00 CSCL 01C

The model was a full-scale mockup of a light single-engine high-wing monoplane. Tests were made over an angle-of-attack range of -4 deg to 24 deg and over a sideslip range of plus or minus 8 deg at thrust coefficients of 0, 0.14, and 0.30. Control effectiveness and hinge moments were taken on the aileron, elevator, and rudder for a full range of deflections. Downwash measurements at the tail were obtained for the range of thrust coefficient and flap deflection. Author

N73-25069*# Scripta Technica, Inc., Washington, D.C.
THE ECONOMICS OF AIR TRANSPORT
N. N. Gromov, Ye. V. Mukhordykh, Ye. A. Ovrutskiy, G. A. Parsegov, B. M. Parakhonskiy, Ya. I. Prutkin, and L. A. Tsekhanovich NASA May 1973 265 p refs Transl. into ENGLISH of the book "Ekonomika Vozdushnogo Transporta" Moscow, Transport Press, 1971 p 1-245
(Contract NASw-2036)
(NASA-TT-F-741) Avail: NTIS HC $3.00 CSCL 05C

A brief exposition of the basic problems of air-transport economics is presented. On the basis of analysis of a large amount of factual material and generalization of scientific data, the authors cast light on the basic economic patterns in the development of air transport. Problems of increasing the efficiency of air-transport utilization and improving management and planning occupy a central position in the book in accord with the resolutions of the September (1965) Plenary Session of the Central Committee of the Communist Party of the Soviet Union (CC CPSU), the Twenty-Third Party Congress, and the December (1969) Plenary Session of the CC CPSU. Areas requiring improvement are brought out in analyses of specific problems, and prospects for the development of air transport are set forth. Author

N73-25070*# Bell Helicopter Co., Fort Worth, Tex.
FULL SCALE HOVER TEST OF A 25 FOOT TILT ROTOR
S. Helf, E. Broman, S. Gatchel, and B. Charles 16 May 1973 135 p refs
(Contract NAS2-7308)
(NASA-CR-114626; Rept-300-099-010) Avail: NTIS HC $8.75 CSCL 01A

The tilt rotor underwent a hover performance test on the Aero Propulsion Laboratory whirl stand at Wright-Patterson Air Force Base. The maximum thrust over density ratio measured at the design tip speed of 740 feet per second was 10,016 pounds. This occurred when the power over density ratio was 1721 horsepower. At the hover overspeed rpm, the thrust and power, over density ratio, were 11,008 pounds and 1866 horsepower. During the test, the maximum measured thrust coefficient was 0.177, and the rotor figure of merit exceeded 0.81. Measured lifting efficiency was 8.35 pounds per horsepower at the thrust a 13,000-pound aircraft would require for hover at sea level on a standard day. No effect of compressibility on performance is discernible in the test results (the range of tip Mach numbers tested was 0.55 to 0.71). Author

N73-25071# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario). Behavioural Sciences Div.
REAR COCKPIT RECONFIGURATION OF THE CF100 EW AIRCRAFT
Leslie G. Innes Dec. 1972 12 p
(DCIEM-904) Avail: NTIS HC $3.00

The CF100 aircraft is to be re-equipped with new avionics in the rear (navigators) cockpit for upgrading its electronics warfare training capability. Human engineering assistance was provided during the cockpit reconfiguration stage, and a full-scale mock-up, prepared to test the feasibility of specific equipment layouts, demonstrated the recommended configuration. Author

N73-25072*# Goodyear Aerospace Corp., Akron, Ohio.
ENGINEERING DESIGN MANUAL OF PARACHUTE DECELERATOR CHARACTERISTICS FOR SPACE SHUTTLE SOLID ROCKET BOOSTER RECOVERY Technical Report, 2 Nov. 1972 - 1 May 1973
David L. Mansfield 1 May 1973 146 p
(Contract NAS8-29144)
(NASA-CR-124266; GER-15887) Avail: NTIS HC $9.50 CSCL 22C

The design criteria and characteristics of parachutes for recovery of the solid rocket boosters used with the space shuttle launch are presented. A computer program for analyzing the requirements of the parachute decelerators is described. The computer inputs for both the drogue and main parachute decelerators are; (1) parachute size, (2) deployment conditions, (3) inflation times, (4) reefing times, (5) mass properties, (6) spring properties, and (7) aerodynamic coefficients. Graphs of the parachute performance are included. Author

N73-25073*# IIT Research Inst., Chicago, Ill. Engineering Mechanics Div.
DETERMINATION OF THE DISTRIBUTION OF SOUND SOURCE INTENSITIES IN SUBSONIC AND SUPERSONIC JETS Final Technical Report, Jun. 1971 - Feb. 1973
R. J. Damkevala and R. S. Norman Feb. 1973 83 p refs
(Contract NAS8-27011; IITRI Proj. J6246)
(NASA-CR-124563) Avail: NTIS HC $6.25 CSCL 20A

Equations relating crossed beam space-time correlations to the sound source strength per unit length of an idealized jet are presented and applied to actual measurements in unheated jets at M = 0.71 and M = 1.0. The infrared crossed beam system was assembled and checked out. The prediction of the system's insensitivity to temperature fluctuations when set at 4.31 microns with a 0.08 micron bandpass was checked. Relative intensity profiles of density fluctuations for jets at M = 0.71, 1.0 and 1.94 were measured. These profiles differ considerably from velocity fluctuation profiles measured by other investigators with hotwires. The convection speeds also differ. Finally, the sound source strengths per unit length are obtained at various axial distances for the subsonic and sonic jet. The sonic jet shows peak source strength at an axial distance of six diameters. Author

N73-25074# Royal Aircraft Establishment, Farnborough (England).
A COMPUTER PROGRAM FOR CALCULATING FLIGHT PROFILES OF CONCORDE
V. Hilary Mitchell Oct. 1972 36 p refs
(RAE-TR-72102; BR-32220) Avail: NTIS HC $4.00

A computer program which can calculate flight profiles of a Concorde for a variety of flight procedures and atmospheric conditions was written. The layout and capabilities of the program are described and detailed instructions for the preparation of its data, which consists of a series of descriptive phrases, are given. Author (ESRO)

N73-25075# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
COMPUTER PROGRAMS FOR COMPUTATIONAL ASSISTANCE IN THE DESIGN OF AIRCRAFT CONTROL SYSTEMS Technical Report, Jun. - Sep. 1971
Henry J. McGlynn Dec. 1972 191 p refs
(AD-758781; ASD-TR-72-112) Avail: NTIS CSCL 01/3

A package of FORTRAN subroutines capable of generating aircraft transfer functions in six degrees of freedom is presented. Considerable flexibility is afforded in the specification of the reference condition and the vehicle aerodynamic, inertial, and geometric properties. The package is designed to be used with a main program defining the particular system configuration under study. The package has been prepared for use on the CDC 6600, the IBM 7090/7094, and the IBM 360 computers. The report includes program listings. GRA

N73-25076# Technology, Inc., Dayton, Ohio.
T-38 STRUCTURAL FLIGHT LOADS DATA FOR JUNE 1970 - DECEMBER 1971 Final Report, 1 Jun. 1970 - 31 Mar. 1972
Larry E. Clay and Ronald I. Rockafellow Wright-Patterson AFB, Ohio ASD Apr. 1973 148 p refs
(Contracts F33657-70-D-1161; F33657-71-D-0662)
(AD-758891; ASD-TR-72-54) Avail: NTIS CSCL 01/3

In a fifth part of a continuing T-38 Service Loads Recording Program (SLRP) to cover the period from 1 June 1970 through 31 December 1971, 4265 hours of VGH data were recorded by A/A24U-10 magnetic tape recording systems installed in twenty-eight T-38 aircraft: 22 fleet and 6 lead-the-force T-38's operating from Williams, Reese, and Moody Air Force Bases. As in previous reports, the data presentation includes curves showing normal load factor (nz) exceedances above each nz level per thousand flight hours. Only one nz exceeded 7.8 (design limit is 7.33), and the comparison of the exceedance curves for the current and previous programs substantiated that the T-38 nz spectrum had remained unchanged during the T-38 SLRP. (Author Modified Abstract) GRA

N73-25077# Army Foreign Science and Technology Center, Charlottesville, Va.

TAXIING ABILITY OF AN AIRCRAFT ON EARTH
A. A. Degtyarev 11 Aug. 1972 12 p Transl. into ENGLISH from Vestn. Protivovozovshanoi Oporony (Moscow), no. 8, 1965 p 61-66
(AD-756588; FSTC-HT-23-335-72) Avail: NTIS CSCL 01/5

The useability of an aircraft for flights from dirt strips is characterized primarily by its taxiing ability, i.e. its ability to start up from a stop using its engine, accelerate and separate from the ground within the limits of the runway. The track which the aircraft leaves must not be deeper than a certain permissible limit. Calculations of taxiing ability are required for selection and maintenance of dirt air strips and determination of the possibility of performing flights from the strips. The article studies the influence of the characteristics of the aircraft and soil on taxiing ability and the method of calculating taxiing ability. Author (GRA)

N73-25078# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENTS REPORTS: BRIEF FORMAT. US CIVIL AVIATION, ISSUE NO. 4 OF 1971 ACCIDENTS
29 Sep. 1972 513 p
(PB-214412/9; NISB-BA-72-7) Avail: NTIS HC $6.00 CSCL 01B

The publication contains selected aircraft accident reports, in brief format, occurring in U.S. Civil Aviation operations during calendar year 1971. The 899 General Aviation accidents represent a random selection. The publication is issued irregularly, normally six times each year. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors.
Author (GRA)

N73-25079# National Academy of Sciences - National Research Council, Washington, D.C. Environmental Studies Board.
BIOLOGICAL IMPACT OF INCREASED INTENSITIES OF SOLAR ULTRAVIOLET RADIATION Final Report
Kendric C. Smith Feb. 1973 54 p refs
(Contract DOT-OS-00035)
(PB-215524/0; LC-72-13835) Avail: NTIS HC $4.50 CSCL 01C

The possible environmental impacts of a future fleet of supersonic transport (SST) aircraft has become a topic of intense national interest. One of the possibilities discussed was that emissions from SST aircraft might reduce the amount of ozone in the upper atmosphere and thereby lead to an increase in solar ultraviolet (UV) radiation reaching the surface of the earth. The goals of this report are to review some of the known effects of ultraviolet radiation on man and other living organisms; assess, the consequences to man and other living organisms; identify those areas where knowledge is inadequate and where further research is urgently needed. Author (GRA)

N73-25080# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
AIRCRAFT NOISE ANALYSES FOR THE EXISTING AIR CARRIER SYSTEM
1 Sep. 1972 296 p refs
(Contract CON-AAC-72-12)
(PB-215611/5; BBN-2218) Avail: NTIS HC $3.00 CSCL 01C

The objectives of this study were to develop a rational evaluation of the courses of action and costs to alleviate noise exposure in the vicinity of airports, taking into consideration reduction of aircraft noise at the source, the use of various aircraft operational procedures and various means for achieving noise compatible land use. This project utilizes a subset of 12 of these airports as a base to assess the effects of noise control of existing aircraft, new technology aircraft, flight operational variations, and land use conversion on the capital, social, and political costs for achieving a sensible balance between an acceptable noise environment and an expanded air transportation system. Author (GRA)

N73-25081# Booz-Allen Applied Research, Inc., Bethesda, Md.
SYSTEM SELECTION STUDY SYSTEMS EVALUATION TASK (TASK 360)
John Wing and Robert Weirich 9 Jun. 1972 145 p
(PB-215533/1) Avail: NTIS HC $5.45 CSCL 01B

The report describes three basic alternative national aviation systems and evaluation factors for each. As in all complex analyses, the approach taken to defining and evaluating these systems evolved as problems were identified and solved. This report reflects a finer-grained evaluation than originally contemplated. Systems were defined at a demand-center level, rather than solely at a national level. Author (GRA)

N73-25082# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECTS OF STRUCTURAL ELASTICITY ON THE ACCUMULATION OF FATIGUE DAMAGE
T. V. Pavelko 12 Apr. 1973 8 p refs Transl. into ENGLISH from Vopr. Elektromodelirovaniya Aviakonstruckt. (USSR), v. 196, no. 1, 1971 p 24-26
(AD-759634; FTD-HT-23-262-73) Avail: NTIS CSCL 01/3

The article examines the effect of wing elasticity on the repetition of stresses in the sections during flight in turbulence. The investigation was conducted on an electrical model of a heavy transport with straight wings. Author (GRA)

N73-25083# Aerospace Systems, Inc., Burlington, Mass.
A STUDY OF TECHNIQUES FOR REAL-TIME, ON-LINE OPTIMUM FLIGHT PATH CONTROL: MINIMUM-TIME MANEUVERS TO SPECIFIED TERMINAL CONDITIONS Final Technical Report, Aug. 1971 - Nov. 1972
William C. Hoffman and Arthur E. Bryson, Jr. Jan. 1973 48 p refs
(Contracts F44620-72-C-0001; N00014-67-A-0112-0063; AF Proj. 9769)
(AD-758799; ASI-TR-73-12; AFOSR-73-0553TR) Avail: NTIS CSCL 01/3

Some three-dimensional, minimum-time paths to a specified terminal line (or point), heading and energy are presented for an example supersonic aircraft. These paths were calculated using numerical solution techniques implemented in a digital computer program for the CDC-6600 computer. The optimum maneuvers have been determined using the calculus of variations and the energy-state approximation. These are compared with suboptimal solutions obtained using only three discrete values of bank angle. Constraints on thrust, Mach number, angle-of-attack, dynamic pressure and load factor are included. (Author Modified Abstract) GRA

N73-25084# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
STRUCTURAL INTEGRITY INVESTIGATION OF DELAMINATED F-4 CANOPIES IN SUPPORT OF THE ANALYTICAL REWORK PROGRAM Final Report
R. P. Swartz 29 Sep. 1972 54 p
(AD-759349; NADC-72179-VT) Avail: NTIS CSCL 01/3

Cyclic pressure tests, under various environmental conditions, were run on the F-4 forward and aft canopies to determine the safe life that could be expected after these canopies had suffered delamination damage of the acrylic sheet. Canopies having edge delaminations were initially tested for 17757 pressure cycles, the equivalent of 7102 hours of flight. Additional damage was then introduced by cutting 1/16 inch deep grooves into the canopy's surfaces. Results are discussed. (Author Modified Abstract) GRA

N73-25085# Loening (Grover), Key Biscayne, Fla.
[TECHNOLOGICAL POSSIBILITIES IN INERTIAL NAVIGATION, V/STOL, AND STOL AIRCRAFT, AND AIR TRAFFIC CONTROL FOR THE YEARS 1975 - 2000] Report to Chairman, Aviation Advisory Commission
Grover Loening 19 Apr. 1972 8 p
(PB-217102) Avail: NTIS CSCL 01B

An analysis of short takeoff aircraft design and development is presented. The subjects considered are: (1) aircraft performance requirements, (2) aircraft equipment for navigation, (3) airframe materials and construction, and (4) reduction of aircraft noise for greater acceptability. The air traffic control aspects of STOL and V/STOL aircraft operation during the period 1975 to 2000 are analyzed. P.N.F.

N73-25086# Bell Helicopter Co., Fort Worth, Tex.
SUMMARY OF DESIGN STUDIES AND RESULTS OF MODEL TESTS OF THE FOLDING-PROPROTOR AIRCRAFT CONCEPT Final Report
J. A. DeTore and E. L. Brown Wright-Patterson AFB, Ohio AFAL Jul. 1972 131 p refs
(Contract F33615-69-C-1578; AF Proj. 643A)
(AD-759534; AFFDL-TR-72-81) Avail: NTIS CSCL 01/3

Design studies and wind-tunnel test investigations were conducted to define preliminary designs of folding-proprotor VTOL aircraft for USAF rescue and transport missions and to identify and investigate technical risk areas. The aircraft had gross weights of 66,000 pounds and extended hover capability to 7,000 feet. Convertible fan-jet engines provided forward flight speeds to 452 knots with blades folded. Technical risk areas associated with the aircraft designs were found to be in areas of mechanisms, aerodynamics, stability and control, and dynamics. A dynamic wind-tunnel investigation, conducted with a semispan aeroelastic model, demonstrated successful continuous stop/fold/unfold/start sequences, and freedom from proprotor/pylon stability and blade flutter. (Author Modified Abstract) GRA

N73-25087# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
WIND TUNNEL FEASIBILITY STUDY OF AERODYNAMIC REEFING OF SUBSONIC PARACHUTES Final Report, Feb. 1970 - Aug. 1972
Helmut G. Heinrich and Robert A. Noreen May 1973 27 p refs
(Contract F33615-68-C-1227)
(AD-759209; AFFDL-TR-72-126) Avail: NTIS CSCL 01/3

The inflation characteristics of solid flat circular model parachutes with stiffness indices in the order of 1.17 and various annular slots were studied in a wind tunnel at velocities up to 265 fps. The amount of the geometric porosity was varied as well as the location of the annular slots. It was found that at a speed of 250 fps models with geometric porosities up to 18% inflated immediately, with porosities between 18% and 28% the models showed random inflation and collapsing, and at porosities of 28% and higher squidding or aerodynamic reefing was observed. The location of the slots did not influence the inflation characteristics significantly. The critical speed was established for a number of models; however, the conclusion was reached that more efforts have to be made in order to understand the mechanics of squidding to be able to take advantage of the principle of aerodynamic reefing for full scale design. Author (GRA)

N73-25088# Pennsylvania State Univ., University Park. Ordnance Research Lab.
THE INFLUENCE OF LEADING EDGE SERRATIONS ON THE NOISE RADIATION FROM A STATICALLY THRUSTING ROTOR M.S. Thesis
Robert T. Nagel 9 Aug. 1972 144 p refs
(Contract N00017-70-C-1407)
(AD-759028; TM-72-188) Avail: NTIS CSCL 01/3

The noise attenuation effects of leading edge serrations on rotors is studied in detail. Total radiated power, far-field SPL, directivity patterns, near-field sound characteristics, rotor slip stream and wake characteristics, and flow patterns have been compared with rotors with and without leading-edge devices. Near-field data were collected in a manner indicative of rotational noise components. A considerable noise reduction in the higher harmonics of rotational noise was detected. Thrust and torque data indicate that the addition of leading edge serrations results in a decrease in L/D. Hot wire data are analyzed. (Author Modified Abstract) GRA

N73-25089# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE CALCULATION OF THE LIFT DISTRIBUTION AND THE NEAR VORTEX WAKE BEHIND HIGH AND LOW ASPECT RATIO WINGS IN SUBSONIC FLOW
Josef Rom and Carlos Zorea Jan. 1973 109 p refs
(Grant AF-AFOSR-2145-71; AF Proj. 9781)
(AD-759262; TAE-168; AFOSR-73-0652TR; SR-2) Avail: NTIS CSCL 01/3

A method is presented for the combined calculation of the lift and lift distribution on a wing and also of the trailing vortex flow behind the wing. It is assumed that the lift of a wing is generated by a system of vortices distributed over the complete wing planform and shed away from each elemental area on the planform. Using the concepts of the vortex lattice method, it is assumed in the linear lift variation case, that the vortices are aligned on the wing planform and are shed away from the trailing edges. Vortex line interaction calculations for the trajectories of the vortex lines are programmed. As a result, the leading edge lift vortices which are obtained on slender wings can now be handled. This report contains a description of the numerical method. (Author Modified Abstract) GRA

N73-25090# Hough Lab., Springfield, Ohio.
UNIQUE FIBROUS FLAME ARRESTOR MATERIALS FOR EXPLOSION PROTECTION Final Technical Report, 20 Jun. - 20 Dec. 1972
Ralph L. Hough, Maro Lavy, and W. Marold Wright-Patterson AFB, Ohio AFAPL Dec. 1972 34 p refs
(Contract F33615-72-C-2153; AF Proj. 3048)
(AD-759193; AFAPL-TR-73-108) Avail: NTIS CSCL 01/3

A flame arrestor serves to prevent the propagation of a flame throughout a flammable media while allowing free passage of the media. Organic foams now being utilized in aircraft fuel cells as arrestors exhibit two serious limitations. These limitations are hydrolytic and thermal instability while in the fuel tank environment. A need exists for new arrestor materials which are more compatible with the currently operational fuel tank environment. In addition, it is desirable that such materials provide potential compatability with more severe environments which might exist in advanced flight vehicle fuel tanks. During the feasibility study, eighteen different combinations of materials and geometries were fabricated and examined for such properties as air flow and density, and compared to baseline polyurethane foam. Promising arrestors were identified by screening in the Hough Laboratory flame tube facility. Some of these arrestors show considerable promise with respect to low density, low cost, extreme resistance to degradation, and effectiveness as a flame arrestor. Author (GRA)

N73-25091# Calspan Corp., Buffalo, N.Y.
DIRECT SIDE FORCE CONTROL (DSFC) FOR STOL CROSSWIND LANDINGS Final Report, 1 May - 31 Dec. 1972
Edward M. Boothe and Howard J. Ledder Wright-Patterson AFB, Ohio AFFDL Feb. 1973 262 p refs
(Contract F33615-72-C-1712; AF Proj. 643A)
(AD-759555; AK-5148-F-1; AFFDL-TR-73-2) Avail: NTIS CSCL 01/2

The application of Direct Side Force Control (DSFC) during crosswind landings of an airplane having the characteristics of a Class II STOL was investigated in the USAF Total In-Flight Simulator (TIFS) airplane. The primary purpose was to evaluate the usefulness of DSFC during the crosswind landing. Other objectives were to investigate the type of cockpit controller or mechanization scheme for use with DSFC, and to define parameters which affect pilot workload during crosswind landings with DSFC. Landing approaches to simulated touchdown were flown both without and with the aid of DSFC. The aporoach speed was 130 knots. Two modes of DSFC control were investigated, an independent manual control of DSFC through a cockpit mounted thumbwheel proportional controller, and an automatic scheme which tracked the ILS localizer signal. (Author Modified Abstract) GRA

N73-25092# Air Force Weapons Lab., Kirtland AFB, N.Mex.
GULLS AND USAF AIRCRAFT HAZARDS Technical Report, 1 Sep. 1971 - 18 Jan. 1972
Rutherford C. Wooten, Jr., George E. Meyer, and Ronald J. Sobieralski Apr. 1973 43 p refs
(AD-759824; AFWL-TR-73-32) Avail: NTIS CSCL 01/2

Gulls are often identified in bird-aircraft collisions in the United States Air Force. A study was performed to determine the impact of gulls on the air mission and to determine the effective means available to reduce the number of strikes. Review of the literature indicates that gull populations are increasing around the country. Unless positive steps are taken around the airport environment, the strike problem will increase. Control

measures include habitat modifications, dispersal techniques, population control, and forecasting and avoidance.
Author (GRA)

N73-25093# Boeing Commercial Airplane Co., Seattle, Wash.
AIRCRAFT HYDRAULIC SYSTEM DYNAMICS Final Report, Jun. - Dec. 1972
Alvin W. Waterman, Arun K. Trikha, and Kenneth D. Groom Wright-Patterson AFB, Ohio Feb. 1973 58 p refs
(Contract F33615-72-C-1699; AF Proj. 3145)
(AD-757537; D6-41108; AFAPL-TR-73-2) Avail: NTIS CSCL 01/3

It is desirable to use computerized analysis techniques in place of costly ground testing and outmoded hand calculations as methods of analyzing aircraft hydraulic system dynamic performance. The current potential for accomplishing this objective was assessed to establish recommendations for future development. Criteria established as desirable features were the use of digital programming and building-block concepts in each of three technical areas (Transient Response, Frequency Response, and Thermal Analysis) needed to describe a composite of system performance. Basic development work was determined to be accomplished in all three technical areas, but in no area did these efforts meet the USAF objectives. Transient Response capability needs improvement to simulate frequency-dependent friction and cavitation characteristics. Frequency Response programming requires much improvement in the technique for analyzing pump/system interactions. Thermal Analysis steady-state analysis programming needs to be expanded to provide transient capability. These efforts are recommended to be accomplished in a coordinated 5-year program with continuous parallel effort being conducted in each of the three technical areas. These efforts involve evaluation of performance characteristics, development of programming subroutines, validation testing against typical aircraft system operational performance, and documentation of programming for general industry use.
Author (GRA)

N73-25094# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AERODYNAMIC INTERFERENCE BETWEEN AN AIRCRAFT AND WING STORE M.S. Thesis
Larry N. Looney Mar. 1973 111 p refs
(AD-759170; GAW/MC/73-10) Avail: NTIS CSCL 01/3

Aerodynamic interference between an aircraft and wing store is studied by the use of analytical wing, fuselage, and store models. Inviscid flow is assumed and the Gothert transformation is used to correct for compressibility. An elliptic wing is represented by a bound vortex followed by a trailing vortex sheet. The fuselage and store are assumed to be slender bodies and modeled by a series of sources and doublets along their axis of revolution. Aerodynamic interference of the aircraft model is studied by observing the store in captive and free flight modes in the vicinity of the wing and fuselage models. The aerodynamic forces and moments experienced by the store as well as store trajectories are computed. Comparisons are made of store reactions (motion and trajectory) to only the wing model and to the wing and fuselage models combined. Author (GRA)

N73-25031 Ministry of Supply, London (England).
EFFECTS OF WING STIFFNESS AND INERTIA CHANGES ON THE MODES AND FREQUENCIES OF MODEL DELTA AIRCRAFT
D. R. B. Webb *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1077-1092 refs Previously issued as RAE-STRUCT-245; ARC-21290 (For availability see N73-25020 16-01)
(ARC-R/M-3268; RAE-R-STRUCT-245; ARC-21290)

N73-25032 Ministry of Aviation, London (England).
THE LOADING OF HELICOPTER ROTOR BLADES IN FORWARD FLIGHT
M. A. P. Willmer *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1093-1136 refs Supersedes RAE-NAVAL-2; ARC-21233 (For availability see N73-25020 16-01)
(ARC-R/M-3318; RAE-R-NAVAL-2; ARC-21233)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-25095*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 BATTERY DESIGN, TEST, AND FLIGHT PERFORMANCE
R. S. Bogner 15 Apr. 1973 194 p
(Contract NAS7-100)
(NASA-CR-132986; JPL-TM-33-591) Avail: NTIS HC $11.75 CSCL 10C

The design, integration, fabrication, test results, and flight performance of the battery system for the Mariner Mars spacecraft launched in May 1971 are presented. The battery consists of 26 20-Ah hermetically sealed nickel-cadmium cells housed in a machined magnesium chassis. The battery package weighs 29.5 kg and is unique in that the chassis also serves as part of the spacecraft structure. Active thermal control is accomplished by louvers mounted to the battery baseplate. Battery charge is accomplished by C/10 and C/30 constant current chargers. The switch from the high-rate to low-rate charge is automatic, based on terminal voltage. Additional control is possible by ground command or onboard computer. The performance data from the flight battery is compared to the data from various battery tests in the laboratory. Flight battery data was predictable based on ground test data. Author

N73-25096*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE MARINER 9 POWER SUBSYSTEM DESIGN AND FLIGHT PERFORMANCE
Robert H. Josephs 15 May 1973 50 p refs
(Contract NAS7-100)
(NASA-CR-132992; JPL-TM-33-616) Avail: NTIS HC $4.50 CSCL 10B

The design and flight performance of the Mariner Mars 1971 power subsystem are presented. Mariner 9 was the first spacecraft to orbit another planet, and some of the power management techniques employed to support an orbital mission far from earth with marginal sunlight for its photovoltaic-battery power source are described. The performance of its nickel-cadmium battery during repetitive sun occultation phases of the mission, and the results of unique tests in flight to assess the performance capability of its solar array are reported. Author

N73-25097*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVED DESIGN OF A HIGH RESPONSE SLOTTED PLATE OVERBOARD BYPASS VALVE FOR SUPERSONIC INLETS
John A. Webb, Jr., Oral Mehmed, and Kirby W. Hiller Washington Jun. 1973 23 p refs
(NASA-TM-X-2812; E-7399) Avail: NTIS HC $3.00 CSCL 20D

The electrohydraulically actuated slotted-plate bypass valve used to control the position of the normal shock during wind-tunnel investigations of supersonic inlets also has proven to be a valuable device for determining inlet dynamics and creating airflow disturbances. Operation of previous valves at high frequencies (to 100 Hz) for extended testing has resulted in numerous failures. An improved bypass-valve design is presented which increases the cyclic tolerance of the device considerably over past designs. The use of dynamic limit criteria to obtain an optimum actuator-piston size results in a frequency response which is flat within + or - 3 decibels to 120 Hz for a peak-to-peak variation of 20 percent of full area. Author

N73-25098*# Pennsylvania Univ., Philadelphia. Electrochemical Engineering Group.
STUDY OF THE ZINC-SILVER OXIDE BATTERY SYSTEM Final Report
Leonard Nanis 19 Apr. 1973 141 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952543)
(NASA-CR-131839) Avail: NTIS HC $9.25 CSCL 10C

Theoretical and experimental models for the evaluation of current distribution in flooded, porous electrodes are discussed. An approximation for the local current distribution function was derived for conditions of a linear overpotential, a uniform concentration, and a very conductive matrix. By considering the porous electrode to be an analog of chemical catalyst structures, a dimensionless performance parameter was derived from the approximated current distribution function. In this manner the electrode behavior was characterized in terms of an electrochemical Thiele parameter and an effectiveness factor. It was shown that the electrochemical engineering approach makes possible the organizations of theoretical descriptions and of practical experience in the form of dimensionless parameters, such as the electrochemical Thiele parameters, and hence provides useful information for the design of new electrochemical systems. Author

N73-25099*# Ion Physics Corp., Burlington, Mass.
DEVELOPMENT OF GALLIUM ARSENIDE SOLAR CELLS Final Report
Mar. 1973 43 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953270)
(NASA-CR-131842) Avail: NTIS HC $4.25 CSCL 10A

The potential of ion implantation as a means to the development of high efficiency gallium arsenide solar cells is investigated. Summaries are included of the results of computer calculations of GaAs cell characteristics, based on a model which includes the effects of surface recombination, junction space-charge region recombination, and built-in fields produced by nonuniform doping in the region; of the fabrication technology developed under the program; and of the results of electrical and optical measurements on the samples produced during the program. It was determined that measured AMO efficiencies were more than a factor of two lower than the calculated values. Author

N73-25100*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
INVERSION LAYER SOLAR CELL FABRICATION AND EVALUATION Midway Report
R. L. Call Dec. 1972 100 p ref Prepared for JPL
(Contracts NAS7-100; JPL-953461)
(NASA-CR-131840) Avail: NTIS HC $7.00 CSCL 10B

Silicon solar cells with induced junctions were created by forming an inversion layer near the surface of the silicon by supplying a sheet of positive charge above the surface. This charged layer was supplied through three mechanisms: (1) supplying a positive potential to a transparent electrode separated from the silicon surface by a dielectric, (2) contaminating the oxide layer with positive ions, and (3) forming donor surface states that leave a positive charge on the surface. A movable semi-infinite shadow delineated the extent of sensitivity of the cell due to the inversion region. Measurements of the inversion layer cell response to light of different wavelengths indicated it to be more sensitive to the shorter wavelengths of the sun's spectrum than conventional cells. Theory of the conductance of the inversion layer vs. strength of the inversion layer was compared with experiment and found to match. Theoretical determinations of junction depth and inversion layer strength were made as a function of the surface potential for the transparent electrode cell. Author

N73-25101# Army Electronics Command, Fort Monmouth, N.J.
LITHIUM-INORGANIC ELECTROLYTE BATTERY SYSTEMS
Wishvender K. Behl, John Christopulos, Maria Ramirez, and Sol Gilman Apr. 1973 28 p refs
(DA Proj. 1T0-61102-A-34A)
(AD-758856; ECOM-4101) Avail: NTIS CSCL 10/3

The report describes a study of prototype room temperature lithium cells employing solutions of LiBCl4 in POCl3 and LiAlCl4 in SOCl2 as electrolytes and polytetrafluoroethylene Teflon-bonded carbon black electrodes as cathodes. A novel feature of these cells is that during discharge the solvents, i.e., POCl3 and SOCl2, are electrochemically reduced and behave as depolarizers. Based on total cell weight, a prototype cell, with a 1.5 molar solution of LiAlCl4 in SOCl2 as the electrolyte, yielded an experimental energy density of 244 Wh/lb for a 57-hour discharge rate (20 mA constant current, 1 mA/sq cm current density). The performance of these cells is also compared with the performance of prototype lithium-organic electrolyte-graphite monofluoride and lithium-inorganic electrolyte-tetracarbon monofluoride cells. Author (GRA)

N73-25102# Bureau of Mines, Washington, D.C.
ECONOMICS OF MIXED POTASSIUM-CESIUM SEEDING OF AN MHD COMBUSTION PLASMA
P. D. Bergman and D. Bienstock Dec. 1972 17 p refs
(PB-214314/7; BM-RI-7717) Avail: NTIS HC $3.00 CSCL 10B

The proposed use of cesium seeded combustion plasmas for open-cycle MHD power generation has attracted considerable interest. Cesium-seeded combustion plasma exhibits a greater electrical conductivity than a potassium-seeded combustion plasma. However, there are drawbacks to cesium seeding such as: the need to use low sulfur coal because of cesium's inability to effectively remove SO2 from the combustion products; the high cost of the cesium ore, pollucite; and cesium's limited availability. Thus, the report looks at the alternative of using a mixture of both potassium and cesium for seeding to overcome these problems. Costs and techniques are also briefly discussed. GRA

N73-25103# Bureau of Mines, Washington, D.C.
EXPERIMENTAL INVESTIGATIONS ON AN OPEN CYCLE, VORTEX MHD GENERATOR
George J. Conroy, Roy C. Kurtzrock, Richard B. Snedden, Joseph J. Demeter, and William F. Hughes Dec. 1972 33 p refs
(PB-214291/7; BM-RI-7699) Avail: NTIS HC $3.75 CSCL 10B

Electrical power generation is studied in a laboratory scale open-cycle vortex MHD generator. The experimental vortex generator consists of a modified cyclone burner 7-1/2 in ID by 21 in long, with the inner wall used as one electrode together with a coaxial center electrode. Power is obtained by impressing an axial field of 3,000 G from an air core solenoid magnet. Tests are conducted with natural gas seeded with potassium acetate and burned with preheated oxygen-enriched air. Author (GRA)

N73-25104# Army Foreign Science and Technology Center, Charlottesville, Va.
CALCULATION AND COST OPTIMIZATION OF CERTAIN SOLAR GENERATOR THERMOBATTERY PARAMETERS
L. M. Drabkin 12 Jan. 1973 12 p refs Transl. into ENGLISH from Geliotekhnika, Akad. Nauk Uz. SSR (Tashkent), no. 1, 1971 p 9-15
(AD-759812; FSTC-HT-23-1433-72) Avail: NTIS CSCL 10/2

A method for economic analysis of thermoelectric generators is discussed in the Russian report. A formula is presented which permits calculation of the cost of manufacture of a thermoelectric generator thermobattery (if material outlay on it is known). From the formula proposed, it follows in particular that, with a decrease in the weight of materials, the cost of a battery decreases linearly. However, with a decrease in the weight of materials (thickness of thermoelements), the number of thermoelements per watt generated grows, approaching infinity. Wage expenditures also increase considerably here. The formula does not take all factors into account, and it is impossible to build up a method for optimizing thermobattery construction parameter design, especially for the solar thermoelectric generator. (Author Modified Abstract) GRA

N73-25105# Gould, Inc., Mendota Heights, Minn.
A 2 POUND DISPOSABLE ZINC-AIR BATTERY, NON-RESERVE, BA-558( )/U AND A 3.3 POUND DISPOSABLE ZINC-AIR BATTERY, NON-RESERVE, BA-559(A)/U Final Report, Apr. 1970 - Nov. 1972
John W. Cretzmeyer Apr. 1973 44 p
(Contract DAAB07-70-C-0167; DA Proj. 1T0-62705-A-053)
(AD-759218; ECOM-0167-F) Avail: NTIS CSCL 10/3

The research described resulted in the development of two disposable zinc-air, non-reserve batteries. The BA-558()/U is a 2-pound, 14 volt, 15 ampere-hour unit. The BA-559(A)/U is a

3.3 pound, 24 volt, 15 ampere-hour unit. Performance and mechanical tests as delineated in Electronics Command Development Description El-CD2078-0001A 7 July 1969 for BA-558() /U and Proposed Performance Specification, 23 August 1972 for BA-559(A)/U were accomplished and all criteria were exceeded. The report contains the individual test results and the details of the construction of the batteries. (Author Modified Abstract) GRA

N73-25106# Systems Research Labs., Inc., Dayton, Ohio.
CONSTRUCTION AND TEST OF AN MHD GENERATOR CHANNEL AND ELECTRICAL POWER CONVERTER Technical Report, 1 Feb. 1971 - 28 Feb. 1972
R. Nimmo, L. Buechler, and K. Irish Nov. 1972 166 p refs
(Contract F33615-71-C-1425; AF Proj. 3145)
(AD-758783; AFAPL-TR-73-5) Avail: NTIS CSCL 10/2

The AFAPL MHD Facility was placed in operation. A peg wall, diagonally connected MHD channel was constructed, making use of materials evaluated in a Hall channel. Seed handling procedures, a new seeding wheel, and timing relations for the burner, fuel flow, oxygen flow, and seed injection were developed. A series of conductivity tests were conducted, and a conductivity of 10 mho's per meter was established. The MHD generator was run at an output of 800 volts, 125 kW with a 2.2 Tesla magnetic field strength. A 2000 Hz converter was designed, constructed and tested to convert a 600 volts dc input to a 50,000 volts ac output. The MHD generator was operated successfully with the new channel for 15 runs of 4 to 6 seconds each, with no appreciable deterioration of the MHD channel or support equipment. Author (GRA)

N73-25107# Pennsylvania State Univ., University Park. Ordnance Research Lab.
THE UNSTEADY RESPONSE OF AN AXIAL FLOW TURBOMACHINE TO AN UPSTREAM DISTURBANCE Ph.D. Thesis
Robert E. Henderson 27 Oct. 1972 179 p refs
(Contract N00017-70-C-1407)
(AD-759029; TM-72-218) Avail: NTIS CSCL 10/1

The results of a study to determine the unsteady response of an axial flow turbomachine rotor to spatial variations in its inlet flow are presented. This study includes the development of a theoretical analysis which permits the unsteady lift of a blade row to be expressed in terms of the usual blade design parameters. With this solution, which includes the unsteady contribution of the entire blade row, the blade spacing, stagger angle and camber can be selected to give a desired level of unsteady response. Comparisons of this solution with existing solutions for blade rows with specified geometries are presented. (Author Modified Abstract) GRA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-25108 National Lending Library for Science and Technology, Boston Spa (England).
DECOMPRESSION DISORDERS AFTER EXPOSURE TO SAFE PRESSURE OR SAFE ALTITUDE
M. P. Yelinskii 12 Mar. 1973 9 p refs Transl. into ENGLISH from Zh. Voenna-Medit. (USSR), Jul. 1970 p 60-63
(NLL-DRIC-Trans-3035-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A sampling of tests is presented pertaining to decompression sickness and accompanying physiological effects resulting from pressure exposures of up to 2.25 absolute atmospheres. Particular note is made of the appearance of gas bubbles in the blood stream in terms of the specific gradients of pressure contributing to their appearance. Additional data is provided on human as well as animal subjects relative to cardiac function impairment, blood pressure, and variable rates of respiration. J.M.M.

N73-25109 National Lending Library for Science and Technology, Boston Spa (England).
METEOROLOGICAL CONDITIONS AND INFECTION OF THE UPPER RESPIRATORY TRACT IN CHILDREN
B. Dziadziuszko [1973] 5 p Transl. into ENGLISH from Gazeta Obs. Pihm (Warsaw), v. 24, no. 9, 1971 p 7-9
(NLL-M-22866-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The influence of meteorological conditions on the seasonal variation in diseases of the upper respiratory tract and their increase in autumn and winter periods among children of one to four years was studied. Increasing morbidity in autumn and winter periods indicated the effects of large but brief fluctuations in atmospheric temperature and humidity in intensified infections of the upper respiratory tract. Author

N73-25110 Wisconsin Univ., Madison.
APPLICATION OF COLOR AND COLOR INFRARED AERIAL PHOTOGRAPHY TO DUTCH ELM DISEASE DETECTION Ph.D. Thesis
Alan Ray Stevens 1972 164 p
Avail: Univ. Microfilms Order No. 72-23764

The feasibility of early and/or previsual detection of D.E.D. (Dutch elm disease) utilizing small format oblique color and color infrared photography taken from a light aircraft is discussed. Laboratory studies centered around the determination of spectral reflectance signatures for healthy elm leaves as well as for those at various stages of stress caused by D.E.D. Examination of pertinent literature showed that the basis for early and/or previsual detection was the decrease in the near infrared reflected energy of a leaf during early stages of stress. In contrast, this study found this to be true only if the tree were infected early in the growing season. It was also found that the reflected infrared energy would decrease as the leaf dropped from its normal healthy angular orientation. A decrease in the near infrared energy was also found upon comparing spectral responses from a portion of an elm crown which was completely foliated to those responses for a portion through which one could see the background. Dissert. Abstr.

N73-25111*# Linguistic Systems, Inc., Cambridge, Mass.
EFFECT OF MONOCHROMATIC LIGHT ON BLOOD CONSTANTS
L. Castells, A. Alomar, and J. Reventos Washington NASA Jun. 1973 10 p refs Transl. into ENGLISH from Rev. Clin. Esp. (Madrid), v. 104, no. 1, 15 Jan. 1967 p 49-52
(Contract NASw-2482)
(NASA-TT-F-14941) Avail: NTIS HC $3.00 CSCL 06P

The effect of monochromatic light on certain blood constants are studied, both in vivo and in vitro, by irradiating the blood by extracorporeal circulation. A dog's retina is also irradiated in vivo. An increase in eritrosedimentation rate and haemolyse is observed. The leucocytes are however decreased. The hyperglycaemia of pancreatectomized dogs is also decreased. Probably this effect is mediated through the hypothalamus in form of a Spectrum-retina-hormone reflex. Author

N73-25112*# George Washington Univ., Washington, D.C. Dept. of Medical and Public Affairs.
SCIENTIFIC PUBLICATIONS AND PRESENTATIONS RELATING TO PLANETARY QUARANTINE. VOLUME 5: THE 1972 SUPPLEMENT
Frank D. Bradley and Marcy R. Nadel Jun. 1973 53 p refs
(Contract NSR-09-010-027)
(NASA-CR-131817; GWU-BSCP-73-14P-Vol-5-Suppl-6) Avail: NTIS HC $4.75 CSCL 06M

The sixth annual supplement to the bibliography on planetary quarantine contains 191 references, an author index and a permuted title index. G.G.

N73-25113*# New Mexico Univ., Albuquerque. Dept. of Biology.
STUDY OF METHODS FOR THE IMPROVEMENT OF BACTERIAL TRANSPORT MEDIA Final Report
Roger L. Gardner and John Wm. Beakley 31 Mar. 1973 27 p refs
(Contract NAS9-12720)
(NASA-CR-128958) Avail: NTIS HC $3.50 CSCL 06M

A series of 500 transport media recipes was tested for ability to hold pure cultures of Streptococcus equisimilus,

Corynebacterium equi, Neisseria perflava, and Haemophilus parainfluenzae for 21 days. Stuart Medium Base with 0.4% agar was used as the control medium for this and the other experiments in the investigation. At the end of the holding period inoculated transport media were quantitatively assayed, and the control media were assayed immediately after inoculation. Three vials of each medium were inoculated with an organism, and each vial's medium was diluted and spread on duplicate plates. Assay media for this experiment included Brain Heart Infusion,(BHIA) Tryptic Soy Agar, and BHIA with 1% Isovitalex enrichment. Author

N73-25114*# Baird-Atomic, Inc., Bedford, Mass.
A STUDY OF MARINE LUMINESCENCE SIGNATURES, PART 1 Final Report
Arthur W. Hornig and DeLyle Eastwood Mar. 1973 156 p refs
(Contract NAS2-6408)
(NASA-CR-114578) Avail: NTIS HC $10.00 CSCL 08A

Fluorescent excitation and emission spectral data on chlorophyll and Gelbstoff in natural sea waters from the Atlantic, Gulf, and Pacific coasts show that algae particulates are totally absorbing over much of the near ultraviolet and visible spectra and act approximately as quantum counters; plant pigments absorb energy and transfer a large portion to chlorophyll where some fraction is emitted as chlorophyll fluorescence. Gelbstoff data do not exhibit quantum counter action because of their low concentration. It is concluded that luminescence data of natural sea waters are useful in monitoring algal and Gelbstoff as well as pollutant concentrations. G.G.

N73-25115*# Baird-Atomic, Inc., Bedford, Mass.
COMPENDIUM OF MARINE LUMINESCENCE SIGNATURES, PART 2 (APPENDIX C)
Arthur W. Hornig and DeLyle Eastwood Mar. 1973 227 p
(Contract NAS2-6408)
(NASA-CR-114579) Avail: NTIS HC $13.50 CSCL 08A

Chlorophyll and Gelbstoff excitation and emission spectra of sea water samples are assembled according to geographic sites from the Atlantic and Gulf coasts, the west coast, and a location north of Hawaii. Data were taken by fluorescent spectrophotometer and include also laboratory algal cultures for comparison with the sea water samples. G.G.

N73-25116*# National Aeronautics and Space Administration, Washington, D.C.
FOURTH ALL-UNION CONFERENCE ON SPACE BIOLOGY AND MEDICINE
Jun. 1973 5 p Transl. into ENGLISH from Med. Gazeta (Moscow), 19 Jan. 1973 p 3, cols. 1-8
(NASA-TT-F-14964) Avail: NTIS HC $3.00 CSCL 06E

A brief summary is presented on topics discussed at the Space Biology and Medicine Conference. Data cover physiology, hemodynamic responses, neuroemotional stresses, radiobiology, medical problems resulting from space flight, and medical experiments conducted onboard spacecraft. E.H.W.

N73-25117# Lockheed Missiles and Space Co., Palo Alto, Calif.
FLUID FLOW IN A TUBE WITH DEFORMABLE WALL IN THE PRESENCE OF VALVES
I. M. Skobeleva [1973] 7 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 5, 1972 p 903-908
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The problem of viscous fluid flow in finite tube with valves at the ends is solved numerically for elastic wall properties varying periodically with time. Of primary concern is the case of blood flow in the veins along which valves are disposed to prevent a reverse current. A solution is constructed of a simple model problem describing a muscular pump under the assumption that the mechanical active muscle activity can be reduced to a given change in effective elasticity, and that the fluid flow is quasi-stationary. D.L.G.

N73-25118# Naval Submarine Medical Research Lab., Groton, Conn.
SPEECH DISCRIMINATION IN NOISE AND HEARING LOSS AT 3000 HERTZ Interim Report
Thomas Murray and Paul G. Lacroix 11 Jul. 1972 16 p refs
(AD-752974; NAVSUBMEDRSCHLAB-719; Rept-7; Rept-73-01201) Avail: NTIS HC $3.00 CSCL 06/19

Navy personnel with normal hearing and with hearing losses at 3 kHz and above were evaluated on tests of speech discrimination in noise. Two tests were used, one previously designed for use in audiological clinics and one constructed at this laboratory with background noise similar to that found in the enginerooms of nuclear submarines. The results indicate that subjects with hearing losses at 3 kHz and above may score as much as 11 percent but more generally at least five percent below normals for a speech discrimination task in noise. For the two types of noise used in these tests, there was little or no difference in the general trend of test result. The correlation coefficients obtained between the pure tone audiometric findings and the speech discrimination task in noise were found to be nonsignificant for the most part. From these results, it appears that hearing loss at 3 kHz reduces one's ability to discriminate speech in noise but this reduction is minor. Author

N73-25119*# Mayo Clinic, Rochester, Minn.
STUDIES OF THE EFFECTS OF GRAVITATIONAL AND INERTIAL FORCES ON CARDIOVASCULAR AND RESPIRATORY DYNAMICS Semiannual Status Report
Erik L. Ritman and Earl H. Wood 1 Apr. 1973 28 p refs
(Grant NGR-24-003-001)
(NASA-CR-133212) Avail: NTIS HC $3.50 CSCL 06S

The current status and application are described of the biplane video roentgen densitometry, videometry and video digitization systems. These techniques were developed, and continue to be developed for studies of the effects of gravitational and inertial forces on cardiovascular and respiratory dynamics in intact animals and man. Progress is reported in the field of lung dynamics and three-dimensional reconstruction of the dynamic thoracic contents from roentgen video images. It is anticipated that these data will provide added insight into the role of shape and internal spatial relationships (which is altered particularly by acceleration and position of the body) of these organs as an indication of their functional status. Author

N73-25120*# Colorado State Univ., Fort Collins.
[HYPOXIA, GAS NARCOSIS, AND METABOLIC RESPONSE TO ARGON AND NITROUS OXIDE] Semiannual Status Report
31 Oct. 1972 55 p refs
(Grant NGR-06-002-075)
(NASA-CR-133214) Avail: NTIS HC $4.75 CSCL 06E

Studies of the mechanism of inert gas influence on metabolism are reported. The studies reported include: metabolic response of hamsters to argon and nitrous oxide, membrane fatty acids and susceptability to narcotic gas influence, narcosis-induced histotoxic hypoxia, biochemical study of inert gas narcosis, hypoxia-induced protection against cardiovascular deterioration in the weightless state, and acute metabolic and physiologic response of goats to narcosis. F.O.S.

N73-25121# Defence Research Information Centre, Orpington (England).
VOICE AND HEARING IN THE SYSTEM OF ACOUSTIC ORIENTATION OF ANIMALS
V. D. Ilichev Feb. 1973 23 p refs Transl. into ENGLISH from Zh. Obshchey Biologii (Moscow), v. 32, no. 3, 1971 p 299-311
(DRIC-Trans-3056; BR-30412) Avail: NTIS HC $3.25

The general rules determining the interrelation of acoustic system in various systematic groups and at various levels of evolution were examined. The acoustic organs sometimes do not reveal homologous successions, and their evolution, from the structural point of view, bears a mosaic character. At the same time, functional characteristics of hearing and voice and the interrelation between them reveal clear changes in the following directions: (1) in the sphere of sound communication, more and more vital situations are involved; (2) the functional (dynamic) range is widened; and (3) the acoustic systems are universalized and their numbers and decreased. The interrelations of the voice and hearing are considered as a biological correlation

of a special type, guaranteeing organismic, populational and biocoenotic channels of interrelation. Author (ESRO)

N73-25122# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

CHANGES IN THE DIURNAL VARIATION OF SIMULATED PILOT ACTIVITY AFTER TIME SHIFT DUE TO AIR TRAVEL THROUGH SEVERAL TIME ZONES Ph.D. Thesis - Bonn Univ. [DIE VERAENDERUNG TAGESZEITLICHER SCHWANKUNGEN SIMULIERTER FLIEGERISCHER TAETIGKEIT UNTER DEM EINFLUSS DER ZEITVERSCHIEBUNG NACH FLUGREISEN UEBER MEHRERE ZEITZONEN]

Hermann Rehme 1973 83 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-25) Avail: NTIS HC $6.25; DFVLR, Porz: 24,80 DM

The 24-hour performance variation of 12 pilots, measured in a flight simulator, was compared with the performance variation on day 1, 3, 5, and 8 after air travel through 8 time zones from east to west (Germany - U.S.A.) and vice versa (return flight after a sojourn of 16 days in the U.S.A.). Conformity of the diurnal performance variation with the preflight values was found on day 3 to 5 after the west flight and on day 5 after the east flight. Therefore, a daily phase shift of 1 to 2 hours was observed. The 24-hour performance average showed a significant decrement of 8.5% only on the first day after the east flight, but not after the west flight. Author (ESRO)

N73-25123# Medical Coll. of Wisconsin, Milwaukee. Dept. of Environmental Medicine.

THE EFFECT OF CARBON MONOXIDE ON TIME PERCEPTION Final Report

Richard D. Stewart, Paul E. Newton, Michael J. Hosko, and Jack E. Peterson Jan. 1973 358 p refs

(PB-214651/2) Avail: NTIS HC $6.00 CSCL 06T

Twenty-seven healthy, adult male and female volunteers were exposed to carbon monoxide at concentrations of 2, 50, 100, 200 and 500 ppm for periods up to 4-1/2 hours for the purpose of determining the effect of the gas upon time perception. These exposures, which resulted in a range of carboxyhemoglobin saturations up to 20 percent, produced no impairment in the ability of the subjects to perform the Beard-Wertheim Time Discrimination Test, to estimate ten or thirty second intervals, or to perform the Marquette Time Estimation Test. Author

N73-25124# Missouri Univ., Columbia.

MECHANISMS OF OXYGEN TOXICITY AT THE CELLULAR LEVEL

Olen R. Brown, Jack L. Stees, Tom Kobbermann, Stan Weaver, and Margaret Lu Jan. 1973 45 p refs

(Contract N00014-67-A-0287-0002; NR Proj. 136-756)

(AD-758725; TR-5) Avail: NTIS CSCL 06/20

The following areas of research are summarized: (1) Two types of pressure chambers were developed for exposure of bacteria and subcellular fractions to hyperbaric oxygen. (2) An electronic automated sampling device was developed to permit kinetic studies of biological transport as affected by hyperoxia. (3) The previously reported correlation between sensitivity to hyperoxia and radiation in bacteria was further studied. Evidence was presented that a small, but measurable amount of hyperoxic damage may occur through production of single-stranded breaks in DNA. (4) Surface SH groups on E. coli are oxidized at a rate of approximately 500 molecules per minute in 6 atm of oxygen, a condition which stops growth and respiration almost immediately. (5) Cellulose acetate membranes were discovered to inhibit growth of some strains of E. coli; the significance of this for water analysis and for experiments utilizing membranes in HPO studies was discussed. (6) Fatty acid synthetase from yeast was purified approximately 150-fold and its sensitivity to HPO was measured. (7) HPO produced reversible inhibition of respiration and transport of glucose and acetate. (Author Modified Abstract) GRA

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-25125* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

UNDERWATER SPACE SUIT PRESSURE CONTROL REGULATOR Patent

Billy R. Aldrich, Charles R. Cooper, and John R. Rasquin, inventors (to NASA) Issued 13 Mar. 1973 7 p Filed 2 Nov. 1971 Supersedes N72-25124 (10 - 16, p 2113) Continuation-in-part of US Patent Appl. SN-869260, filed 24 Oct. 1969

(NASA-Case-MFS-20332-2; US-Patent-3,720,208; US-Patent-Appl-SN-195061; US-Patent-Class-128-142.5; US-Patent-Class-2-2.1A; US-Patent-Class-137-538; US-Patent-Appl-SN-869260) Avail: US Patent Office CSCL 06K

A device is reported for regulating the pneumatic pressure in a ventilated space suit relative to the pressure imposed on the suit when being worn by a person underwater to simulate space environment for testing and experimentation. A box unit located on the chest area of the suit comprises connections for suit air supply and return lines and carries a regulator valve that stabilizes the air pressure differential between the inside and outside of the suit. The valve and suit pressure is controlled by the suit occupant and the valve includes a mechanism for quickly dumping the suit pressure in case of emergency. Pressure monitoring and relief devices are also included in the box unit. Official Gazette of the U.S. Patent Office

N73-25126*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A STUDY OF THE THERMOREGULATORY CHARACTERISTICS OF A LIQUID-COOLED GARMENT WITH AUTOMATIC TEMPERATURE CONTROL BASED ON SWEAT RATE: EXPERIMENTAL INVESTIGATION AND BIOTHERMAL MAN-MODEL DEVELOPMENT

Alan B. Chambers, James R. Blackaby, and John B. Miles Washington Jun. 1973 71 p refs

(NASA-TN-D-7311; A-4686) Avail: NTIS HC $3.00 CSCL 06Q

Experimental results for three subjects walking on a treadmill at exercise rates of up to 590 watts showed that thermal comfort could be maintained in a liquid cooled garment by using an automatic temperature controller based on sweat rate. The addition of head- and neck-cooling to an Apollo type liquid cooled garment increased its effectiveness and resulted in greater subjective comfort. The biothermal model of man developed in the second portion of the study utilized heat rates and exchange coefficients based on the experimental data, and included the cooling provisions of a liquid-cooled garment with automatic temperature control based on sweat rate. Simulation results were good approximations of the experimental results. Author

N73-25127# Beta Industries, Inc., Dayton, Ohio.

INFLATABLE RESTRAINT CONCEPT FOR GENERAL AVIATION AIRCRAFT Final Report, 1 Sep. 1971 - 1 Jul. 1972

Richard W. Carr and Norman S. Phillips May 1973 117 p refs

(Contract DOT-FA71NA-608)

(FAA-RD-73-3; FAA-NA-73-61) Avail: NTIS HC $8.00

A program that investigated inflatable restraint design criteria and developed an airbag restraint system for use in a general aviation aircraft is presented. The program required three phases of effort which were (1) data collection, (2) establishment of design goals, and (3) concept development. The first phase consisted of collecting data on crash acceleration profiles, inflatable restraints, energy attenuation criteria, and airframe dimensions. With this information and available human tolerance data, it was possible to develop analytical models of the seated occupant and airbag restraint, which were used to determine the design goals for inflatable occupant restraints that could be used in general aviation aircraft. Once the design goals were established,

airplane cabin dimensions and inflatable system performance specifications were used to develop an inflatable restraint concept for general aviation aircraft. Author

N73-25128# Naval Submarine Medical Center, Groton, Conn. Vision Branch.
IMPROVING DISTANCE ESTIMATION UNDER WATER: LONG-TERM EFFECTIVENESS OF TRAINING Interim Report
Steven H. Ferris 10 Jul. 1972 10 p refs
(AD-752979; NAVSUBMEDRSCHLAB-718; Rept-11; Rept-73-01205) Avail: NTIS HC $3.00 CSCL 06/19

Due to both optical distortion and water turbidity, divers are usually inaccurate when they estimate distances under water. Previous studies have demonstrated that training with feedback improves judgment accuracy. The present study showed that the effect of training diminishes considerably during the nine weeks following training. A more extensive training program is recommended for diving tasks in which distance estimation is important. Author

N73-25129# Naval Submarine Medical Research Lab., Groton, Conn.
MASKING AS AN INDICATOR OF NEURAL FATIGUE: A PRELIMINARY STUDY Interim Report
Saul M. Luria and Alma P. Ryan 23 May 1972 13 p refs
(AD-752975; NAVSUBMEDRSCHLAB-709) Avail: NTIS HC $3.00 CSCL 06/19

An attempt was made to determine if the basic neural phenomenon of masking could be used as an indicator of fatigue or stress in individual nervous systems. Results show that after prolonged viewing of a moving pattern, the apparent brightness of a moving line is reduced. As a result, the masking effectiveness of the moving line is also reduced. A reduction in the luminance of the moving line by an amount equal to the reduction in apparent brightness produced an equivalent reduction in masking effectiveness. Author

N73-25130*# Argonne National Lab., Ill. Chemical Engineering Div.
RESEARCH ON OXYGEN RECOVERY SYSTEMS FOR USE IN SPACE CAPSULES Progress Report, Feb. 1972 - Jan. 1973
J. R. Selman, R. K. Steunenberg, and E. J. Cairns Feb. 1973 52 p refs
(NASA Order A-70738-A)
(NASA-CR-114573; ANL-8018) Avail: NTIS HC $4.75 CSCL 06K

An improved electrochemical process was investigated for the recovery of oxygen from the atmospheres of manned space capsules. The objective of the proposed system is to recover the oxygen from CO2 with high efficiency and to recover the additional amount of oxygen from water that is required to provide a total oxygen makeup stream of about 2.0 lb/man-day. The carbon from the CO2 must be converted into a readily disposable or usable form. The results are given of initial experiments with a porous stainless steel cathode in a LiCl-KCl electrolyte with small additions of oxide, carbonate, and hydroxide. Author

N73-25131*# Washington Univ., St. Louis, Mo. Center for Development Technology.
EARLY CHILDHOOD EDUCATION: STATUS TRENDS, AND ISSUES RELATED TO ELECTRONIC DELIVERY
Donna Rothenberg May 1973 121 p refs
(Grant NGL-26-008-054)
(NASA-CR-133028; Memo-73/2) Avail: NTIS HC $8.25 CSCL 05E

The status of, and trends and issues within, early childhood education which are related to the possibilities of electronic delivery of educational service are considered in a broader investigation of the role of large scale, satellite based educational telecommunications systems. Data are analyzed and trends and issues discussed to provide information useful to the system designer who wishes to identify and assess the opportunities for large scale electronic delivery in early childhood education. Author

N73-25132*# Loewy (Raymond)/Snaith (William), Inc., New York.
HABITABILITY STUDY, EARTH ORBITAL SPACE STATIONS Final Report, Jan. - Jun. 1972
30 Jun. 1972 36 p
(Contract NAS8-28362)
(NASA-CR-124276) Avail: NTIS HC $4.00 CSCL 05E

Work is reported aimed at supporting the shuttle payload carriers, such as, the Sortie Carrier and RAM. Sketches, renderings, descriptions of scale models and full scale mock-ups, and reports required to fully explain the design recommendations are presented. Author

N73-25133*# Martin Marietta Corp., Denver, Colo.
CONCEPTUAL DESIGN STUDY FOR A TELEOPERATOR VISUAL SYSTEM, PHASE 2 Final Report
C. Grant, R. Meirick, C. Polhemus, R. Spencer, D. Swain, and R. Twell Apr. 1973 204 p refs
(Contract NAS8-29024)
(NASA-CR-124273; MCR-73-96) Avail: NTIS HC $12.25 CSCL 05H

An analysis of the concept for the hybrid stereo-monoscopic television visual system is reported. The visual concept is described along with the following subsystems: illumination, deployment/articulation, telecommunications, visual displays, and the controls and display station. F.O.S.

N73-25134# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
HUMAN PERFORMANCE CAPABILITY IN THE AIRCRAFT ACCELERATION ENVIRONMENT OF AERIAL COMBAT
Kenneth A. Smiles 1972 21 p ref Presented at AFSC Sci. and Eng. Symp., San Antonio, Tex., 17-19 Oct. 1972
(AF Proj. 7222)
(AD-759174; AMRL-TR-72-60) Avail: NTIS CSCL 06/19

Five healthy, young male subjects performed a two dimensional compensatory tracking task using a simulated heads-up predictive gunsight in the gondola of a human centrifuge. The gunsight responded to control stick movement after passage of the signal through the dynamics of a high performance aircraft. The target had a random noise forcing function on the roll axis and a haversine function on the pitch axis. The most significant differences in pilot performance were between subjects. Individual differences were much larger than the effects of training or Gz load. The subjects showed a highly significant deterioration in performance during the pitch and they did not recover to pre-G performance levels immediately after G stress. This effect became more exaggerated as the G levels increased. The subjects improved in pre-G and post-G performance, but their performance during G changed very little with training. (Author Modified Abstract) GRA

N73-25135# Aerospace Medical Div., Brooks AFB, Tex.
USAF TECHNICAL OBJECTIVE DOCUMENT (TOD): AEROSPACE BIOTECHNOLOGY
Thomas D. N. Douthit 1973 48 p
(AD-759277; AMD-TR-1-73) Avail: NTIS CSCL 06/2

The document is directed to the exploratory development conducted under the Aerospace Biotechnology program element. Some operational problem areas such as crew survivability/vulnerability transcend several major subdivisions of the Technical Objective Document, and some methodologies, such as measurement of effects of operational environments on performance ability of crewmen, are used to achieve the goals described in several areas. (Author Modified Abstract) GRA

N73-25136# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
LIMITATIONS OF UNAIDED EYE VISUAL TARGET DETECTION FROM HIGH SPEED LOW FLYING AIRCRAFT CORRELATED WITH TARGET BACKGROUND ENVIRONMENT Technical Summary Report
Bruno K. Wernicke Feb. 1973 69 p refs
(AF Proj. 7645)
(AD-759651; AFAL-TR-72-188) Avail: NTIS CSCL 17/8

Some of the limitations of detecting tactical targets with the unaided eye in high speed low flying aircraft are investigated. The situations selected are those frequently encountered in the

European theatre during the winter months, up to and including the mid-day time period and during the summer months in the morning or evening hours. As explained in the first section of this report, even a detailed search cannot provide an accurate prediction capability without specific boundaries for the environmental situation. In the report one case of a slant range field of view from low-flying aircraft (F-4C) is investigated in regard to the minimum contrast ratio required between a target and its immediate environment in order that it be detectable by the airborne observer. (Author Modified Abstract) GRA

N73-25137# Defence Research Information Centre, Orpington (England).
DECOMPRESSION DISORDERS AFTER EXPOSURE TO SAFE PRESSURE OR SAFE ALTITUDE
M. P. Elinskii Jan. 1973 10 p refs Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), Jul. 1970 p 60-63
(AD-756263; DRIC-Trans-3035; BR-30399) Avail: NTIS CSCL 06/19

From experimental studies and clinical observations cited, it is clear that decompression starting from 2.25 atm abs or less and also ascents to an altitude of less than 8000 m may lead to the appearance of gas bubbles in the blood and sometimes cause severe decompression sickness. Such cases are probably not always spotted because of the widely held view that disorders do not occur with such pressure drops. The problem raised in this paper seems to be of practical importance because if decompression sickness may arise after exposure to a depth of 12.5 m, this points to the formation of gas bubbles large enough to cause embolism. From this it follows that uninterrupted ascent from these depths is not always harmless, particularly as occult gas bubbles may be formed leading to subclinical forms of decompression sickness. In the second place saturation of the organism with nitrogen and other gases at a pressure of 2.25 atm abs may not be taken as an index of safe supersaturation - both now and hitherto calculations of tables for stepwise decompression are based on the assumption that a pressure drop in the ratio of 2.25:1 does not cause disease. It is possible that the need to reduce the factor with increasing depths is primarily due to a false concept of the complete safety of ascending from a depth of 12.5 m. GRA

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-25138 National Lending Library for Science and Technology, Boston Spa (England).
THE STRUCTURE AND CHEMICAL COMPOSITION OF COMPOUNDS FORMED ON THE SURFACE OF METALS IN THE PRESENCE OF COMPLEX-FORMING REAGENTS
N. G. Klyuchnikov 12 Mar. 1973 10 p refs Transl. into ENGLISH from Uch. Zap. Mosk. Gos. Pedagog. Inst. (USSR), v. 340, 1971 p 278-285
(NLL-DRIC-Trans-3020-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

An X-ray study was made of phase compounds formed on the surfaces of iron, zinc, copper and cobalt in the presence of the complex forming reagents cupferon, 8-hydroxyquinoline, benzotriazole, and alpha-nitroso-beta-naphthol. The identity of the phase compounds formed in heterogeneous reactions of these metals with above reagents was established. G.G.

N73-25139 National Lending Library for Science and Technology, Boston Spa (England).
THE ELECTROPHORETIC FLOW PROCESS
P. N. Paulus 12 Mar. 1973 14 p Transl. into ENGLISH from Galvanotech. Oberflaechenschutz (Zurich), v. 8, no. 6, 1967 p 135-141
(NLL-OA-Trans-833-(6196.3)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The electrophoretic painting process is described in detail and the schematic layout of a plant for coating heating oil storage tanks by this method is outlined. Electrophoretic technique applies electromagnetic fields to liquid nozzle flow so that the negatively charged paint particles migrate to the anodic workpiece to which they give up their electric charge. G.G.

N73-25140*# AiResearch Mfg. Co., Los Angeles, Calif.
CO2 REMOVAL BY SOLID AMINE SORBENTS. 1: EXPERIMENTAL STUDIES OF AMINE RESIN IR-45 WITH REGARD TO SPACECRAFT APPLICATIONS. 2: COMPUTER PROGRAM FOR PREDICTING THE TRANSIENT PERFORMANCE OF SOLID AMINE SORBENT SYSTEMS
R. M. Wright and K. C. Hwang 1 Jun. 1973 84 p refs
(Contract NAS1-8559)
(NASA-CR-112324; Rept-73-9091) Avail: NTIS HC $6.25 CSCL 07D

The sorbent behavior of solid amine resin IR-45 with regard to potential use in regenerative CO2-removal systems for manned spacecraft is considered. Measurements of equilibrium sorption capacity of IR-45 for water and for CO2 are reported, and the dynamic mass transfer behavior of IR-45 beds is studied under conditions representative of those expected in a manned spacecraft. A digital computer program was written for the transient performance prediction of CO2 removal systems comprised of solid amine beds. Also evaluated are systems employing inorganic molecular-sieve sorbents. Tests show that there is definitely an effect of water loading on the absorption rate. Author

N73-25141*# Texas A&M Univ., College Station. Remote Sensing Center.
WATER QUALITY PARAMETER MEASUREMENT USING SPECTRAL SIGNATURES
P. E. White May 1973 171 p refs
(Grant NGL-44-001-001)
(NASA-CR-132997; RSC-42) Avail: NTIS HC $5.75 CSCL 07D

Regression analysis is applied to the problem of measuring water quality parameters from remote sensing spectral signature data. The equations necessary to perform regression analysis are presented and methods of testing the strength and reliability of a regression are described. An efficient algorithm for selecting an optimal subset of the independent variables available for a regression is also presented. Author

N73-25142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE FORMATION OF HYDROCHLORIC ACID AEROSOL FROM THE INTERACTION OF THE SPACE SHUTTLE ROCKET EXHAUST WITH THE ATMOSPHERE
Robert A. Rhein 1 Jun. 1973 17 p refs
(Contract NAS7-100)
(NASA-CR-132993; JPL-TM-33-619) Avail: NTIS HC $3.00 CSCL 07D

A description is given of conditions of atmospheric temperature and relative humidity under which hydrochloric acid aerosol is expected upon interaction of the proposed space shuttle rocket exhaust products with the atmosphere. Author

N73-25143# National Bureau of Standards, Washington, D.C. Polymer Chemistry Section.
POLYMERIZATION STUDIES UNDER HIGH PRESSURE Final Report, Sep. 1960 - Sep. 1972
Daniel W. Brown Sep. 1972 10 p refs
(AROD Proj. 2703-C; NBS Proj. 31102-11-3110525)
(AD-750151; Rept-73-01207) Avail: NTIS HC $3.00 CSCL 07C

The combined effect of pressure and ionizing radiation on polymerization processes was studied. Fluoroolefins were emphasized because of prior experience in fluorocarbon synthesis and because this class of relatively simple molecules had resisted polymerization by ordinary free radical, ionic, and Ziegler-Natta catalysis. The bases of the approach were small but favorable theoretical and observed effects of pressure on polymerization rates and equilibria and the anticipated ability to control the initiation rate by varying the radiation intensity. Ionic polymerizations at high pressure were also studied. Author

N73-25144*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CYCLIC OXIDATION EVALUATION: APPROACHING APPLICATION CONDITIONS
C. A. Barrett and E. B. Evans 1973 23 p refs Presented at the Am. Ceramic Soc., Cincinnati, 2 May 1973
(NASA-TM-X-68252; E-7527) Avail: NTIS HC $3.25 CSCL 07D

A survey is presented of the cyclic furnace and burner rig oxidation facilities at NASA-Lewis Research Center together with a review of selected test results and an initial interpretation of the data obtained. Cyclic furnace tests are used to conveniently screen alloy oxidation resistance and spall tendency; high velocity tests further indicate dynamic environmental resistance. Alloys which form scales predominantly of Cr2O3/chromite spinel spall much more than those forming alpha Al2O3/aluminate spinel scales. Weight changes due to scale spalling were used to estimate alloy depletion/thickness losses. Author

N73-25145# Atomic Energy of Canada Ltd., Chalk River (Ontario). Chemical and Materials Div.
[VARIOUS STUDIES IN SOLID STATE, GENERAL CHEMISTRY, PHYSICAL CHEMISTRY, AND MATERIALS SCIENCE RESEARCH] Progress Report, 1 Jul. - 30 Sep. 1972
Oct. 1972 106 p refs
(AECL-4351; PR-CMA-22) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $2.00

Research is reported for studies in Solid State Science Branch, General Chemistry Branch, Physical Chemistry Branch (including radiation and isotope chemistry), and Materials Branch. Publications resulting from the work are listed. NSA

N73-25146# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
DETERMINATION OF THE THERMOPHYSICAL PROPERTIES OF COMPRESSED GASEOUS AND LIQUID FLUORINE
G. C. Straty, R. Prydz, R. D. Goodwin, and B. A. Younglove 1 Jul. 1972 230 p refs
(Contract F04611-70-X-0001; NBS Proj. 2750144)
(AD-758813; NBS-10747) Avail: NTIS CSCL 07/4

Since March 1967, the Properties of Cryogenic Fluids Section, NBS Cryogenics Division, under sponsorship of the Air Force Rocket Propulsion Laboratory, Edwards, California, has been engaged in a comprehensive effort to generate thermophysical properties data on fluorine through precision measurements and computational programs. This effort was divided into three basic phases: Testing of materials, construction of apparatus and modification of existing equipment for compatibility with fluorine; Experimental measurements; and Computation of derived thermodynamic and transport properties from the data. The purpose of the report is to summarize this work and to bring together under a single cover the results of these programs. Author (GRA)

N73-25147# British Steel Corp., London (England). Metallurgy Dept.
SPARK SOURCE MASS SPECTROMETRY. PART 1: DEVELOPMENT IN INSTRUMENTATION AND TECHNIQUES
K. B. Wrigley and E. A. Dubois Oct. 1972 16 p refs
(PB-214212; MG/CC/569/72) Avail: NTIS HC $3.00 CSCL 07D

Developments in the instrumentation and analytical technique of spark source mass spectrometry are reported. Following a short introduction relating to historical developments the report concentrates on instrumental development over the past 6 years; in particular, details of electrical methods of detection are described. Developments in techniques are also described with particular reference to sample preparation techniques. Author (GRA)

N73-25148# British Steel Corp., London (England).
QUALITATIVE ANALYSIS OF STEELWORKS MATERIALS BY THIN LAYER CHROMATOGRAPHY
H. J. Boniface, R. OLeary, and R. H. Jenkins Oct. 1972 11 p refs
(PB-214232/1; BISRA-SM/556/A) Avail: NTIS HC $3.00 CSCL 07D

A published scheme for the identification of cations by thin layer chromatography has been modified to produce a simpler operating procedure. Fifteen cations, viz., Fe, Sn, Cd, Zn, Co, Cu, Mn, V, Pb, Cr, Al, Ca, Mg, Ti and Ni can be detected in a variety of steelworks materials. The scheme is particularly useful in providing preliminary qualitative information, from which a suitable analytical technique may be chosen for quantitative analysis. Author (GRA)

N73-25149# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT AND APPLICATION OF TUNABLE DIODE LASERS TO THE DETECTION AND QUANTITATIVE EVALUATION OF POLLUTANT GASES Final Technical Report
E. David Hinkley and J. O. Sample 31 Mar. 1972 65 p refs
(Contract F19628-70-C-0230)
(PB-214240/5; EPA-R2-72-090) Avail: NTIS HC $3.00 CSCL 07D

Results are presented of a program concerned with the development of tunable semiconductor diode lasers and their potential application toward solving some of the air pollution monitoring problems. The tunable diode lasers developed under the program are described. Infromation is given concerning some of the spectroscopic information obtained from the laser scans of portions of the gamma 1 band of SO2 between 1100 and 1200/cm, with special attention to comparison between experiment and theory. Initial experiments confirming the theory for remoter heterodyne detection are described. Next, experiments are discussed which relate to potential monitoring applications. GRA

N73-25150# Miami Univ., Oxford, Ohio.
ANALYTICAL CHEMICAL RESEARCH, SUPPORT AND SERVICE Annual Summary Report, 1 Oct. 1971 - 31 Oct. 1972
John E. Katon Dec. 1972 26 p refs
(Contract F33615-72-C-1040; AF Proj. 7360)
(AD-758805; AFML-TR-73-5) Avail: NTIS CSCL 07/4

The report briefly summarizes the research and support programs and service functions covering determination of molecular structures, characterization of materials and development and application of analytical techniques of various kinds. The contract also involves various services supplied the Air Force in support of their in-house programs. The major areas of research and support were in emission spectrometry, mass spectrometry, microchemical analyses and vibrational spectroscopy. In emission spectrometry special techniques for the analysis of strontium, calcium and cadmium fluorides were developed. Vibrational spectroscopic studies concentrated on far infrared group frequencies, the structures of acids, and crystallization phenomena. Mass spectrometric studies involved the development of an analytical method for trace amounts of water. (Author Modified Abstract) GRA

N73-25151# Naval Postgraduate School, Monterey, Calif. Dept. of Physics and Chemistry.
STABILITY CONSTANTS FOR THE CHLORIDE COMPLEXES OF PALLADIUM (2) M.S. Thesis
Richard Leon Burke Dec. 1972 62 p refs
(AD-758684) Avail: NTIS CSCL 07/4

Using absorbance data from Pd (II) solutions containing varying amounts of chloride ion, the stepwise formation constants were determined for the following system: reversible reactions Pd(OH2)4(+2) Pd(OH2)3Cl(+) Pd(OH2)2Cl2 Pd(OH2)Cl3(-) Pd Cl4(-2). Anomalies arising from the resulting values and values obtained by other workers are discussed. Suggestions for further work in the chloro- Pd (II) system are made. Author

N73-25152# Aerospace Corp., El Segundo, Calif. Lab. Operations.
MONTE CARLO CALCULATIONS OF REACTION RATES F PLUS HF(v) YIELDS HF(v') PLUS F AND F PLUS DF(v) YIELDS DF(v') PLUS F Report for Jul. - Nov. 1972
Roger L. Wilkins 4 Apr. 1973 30 p refs
(Contract F04701-72-C-0073)
(AD-758753; TR-0073(3430)-10; SAMSO-TR-73-130) Avail: NTIS CSCL 07/4

Rate constants have been calculated for vibrational relaxation of HF(v) and DF(v) by F atoms with v = 1, 2, 3, and 6.

Three-dimensional classical trajectories of the collision dynamics of these exothermic reactions were calculated by means of the modified London-Eyring-Polanyi-Sato (LEPS) potential energy surface used in a previous paper to calculate rate constants for the reactions between H atoms and F2 and D atoms and F2. The Monte Carlo procedure is used to start each collision trajectory. Two different methods are used to calculate the rate constants k(v to v-1) for the vibrational de-excitation of HF by F atoms. The main mechanism for de-excitation of vibrationally excited HF and DF by F atoms is vibration-rotation energy transfer. Rate constants are provided for many reactions that have not been measured experimentally. Author (GRA)

N73-25153# Aerospace Corp., El Segundo, Calif. Lab. Operations.

MONTE CARLO CALCULATIONS OF REACTION RATES AND ENERGY DISTRIBUTION AMONG REACTION PRODUCTS F/HD YIELDS HF/D AND F/HD YIELDS DF/H Technical Report, Sep. - Dec. 1972

Roger L. Wilkins 30 Mar. 1973 22 p refs
(Contract F04701-72-C-0073)
(AD-758759; TR-0073(3430)-15; SAMSO-TR-73-142) Avail: NTIS CSCL 07/4

Rate constants are calculated for the exothermic reactions F - HD (v, J) to HF(v', J') - D and F - HD(v, J) to DF(v', J') - H by analyzing the results of three-dimensional classical trajectories on an assumed London-Eyring-Polanyi-Sato (LEPS) potential energy surface. The Monte Carlo method is used to start each collision trajectory. Data are presented for the temperature dependences of (1) the overall rate constants, (2) the rate constants for the formation of HF and DF in specified vibrational, states, and (3) the distribution of vibrational, rotational, and translational energies in the products of exothermic reactions. The relative rate constants at room temperature for the formation of HF and DF in specific vibrational states are given. The very efficient conversion of reaction energy into product vibrational energy was due to the repulsive energy released and the heavy attacking atom. (Author Modified Abstract) GRA

N73-25154# Princeton Univ., N.J. Dept. of Chemical Engineering.

PYROLYSIS-MOLECULAR WEIGHT CHROMATOGRAPHY OF POLYMERS

J. K. Gillham and E. Kiran Apr. 1973 47 p refs Submitted for publication
(Contract N00014-67-A-0151-0024; NR Proj. 356-504)
(AD-758711; TR-14) Avail: NTIS CSCL 07/3

A pyrolyzer with programming capability has been coupled in series with a thermal conductivity cell and a mass chromatograph. The thermal conductivity cell gives the flexibility for selective trapping of decomposition products, and also provides data that are complementary to thermogravimetric and differential thermal analyses. The mass chromatograph is composed of two gas chromatographs that are run parallel from a common injection port. Each chromatograph uses a different carrier gas, and is equipped with a gas density balance detector. The instrument simplifies identification of mixtures of unknowns in directly providing molecular weights, absolute quantities and gas chromatographic retention times of the constituents. In this respect, the present system is analogous to pyrolysis-gas chromatography-mass spectrometry. Discussion of the technique and its application to the investigation of the thermal degradation of low density polyethylene are presented. Author (GRA)

N73-25155# Brandeis Univ., Waltham, Mass.

AERODYNAMICS OF GASES AND INTERACTION WITH RADIATION Final Report, 15 Feb. 1972 - 15 Feb. 1973

Eugene P. Gross 10 Apr. 1973 5 p refs
(Grant AF-AFOSR-2279-72; AF Proj. 9767)
(AD-758852; AFOSR-73-0588TR) Avail: NTIS CSCL 07/4

The report very briefly describes the results of a year's research. A theory of the collision broadening of the rotational spectrum of gases has been published. It can be used to analyze experimental results. Work was carried out on the moment method in kinetic theory and plasma physics. Work was done on a variational approach to the Boltzmann equation. (Author Modified Abstract) GRA

N73-25156# Stanford Univ., Calif. Dept. of Chemistry.

THE STRUCTURE AND PROPERTIES OF POLYMERIC AND MACROMOLECULAR MATERIALS Final Report, 15 Aug. 1970 - 31 Aug. 1972

Paul J. Flory Feb. 1973 11 p refs
(Grants AF-AFOSR-1960-71; AF-AFOSR-2232-72; AF Proj. 9537)
(AD-758837; AFOSR-73-0636TR) Avail: NTIS CSCL 07/3

Principal lines of research actively pursued during the period of the author's grant are as follows: General theory of polymer chain configuration; Optical properties of polymer chains; Small angle-X-ray scattering by chain molecules; and Properties of vinyl polymers in relation to molecular structure. Results and complete details of the investigations carried out in these four areas are given in 22 papers completed for publication during the period of this grant. The main accomplishments are described in the body of the report. Bibliographies of papers published are included there as well. (Author Modified Abstract) GRA

N73-25157# Army Foreign Science and Technology Center, Charlottesville, Va.

DETERMINATION OF EFFECTIVENESS OF AEROSOL PARTICLE WASHOUT BY WATER DROPS

N. P. Yasevich 1 Mar. 1973 13 p refs Transl. into ENGLISH from Tr. Inst. Eksperim. Meteorol. (USSR), no. 9, 1970 p 42-51
(AD-759667; FSTC-HT-23-342-73) Avail: NTIS CSCL 07/1

The study of the process of capture of solid aerosol particles by drops is of interest in meteorology and technology. As a result of the collision of falling raindrops against solid dust particles suspended in air, these particles are washed out of the earth's atmosphere. Water spraying by jets is used in mines and pits for cleaning dust particles out of the air. Operation of spraying absorption towers is based on the process of capture of solid aerosol particles by liquid drops. This work was carried out with the aim of determining the effectiveness of solid aerosol particle washout by water drops at low Reynolds numbers. GRA

N73-25158# Maryland Univ., College Park. Dept. of Physics and Astronomy.

CONCENTRATION FLUCTUATIONS IN THE CRITICAL REGION OF THE BINARY LIQUID 3-METHYLPENTANE-NITROETHANE

Paul H. Keyes, Ren-Fang Chang, Jan V. Sengers, and Carroll O. Alley Sep. 1972 120 p refs
(Contract N00014-67-A-0239-0014)
(AD-759740; TR-73-018) Avail: NTIS CSCL 07/4

The intensity and Rayleigh linewidth have been measured as a function of temperature and scattering angle for light scattered by concentration fluctuations near the critical mixing point of the binary liquid mixture 3-methylpentane-nitroethane. The data were obtained at the critical concentration above T(c) and on both sides of the coexistence curve below T(c). The susceptibility and the correlation length, xi, were determined as a function of the temperature from the intensity data. The decay rate Gamma of the concentration fluctuations was determined from the linewidth measurements. The ratio of the correlation lengths at equal temperature intervals above and below T(c) was obtained from a comparison of both the intensity and the spectral measurements taken in these two regions. The observed variation of Gamma with K xi was compared with the theory of Kawasaki. The authors also review some recent improvements in the Kawasaki theory, reported by Kawasaki and Lo and by Perl and Ferrell, in which the viscosity is properly treated as a k and xi dependent quantity. GRA

N73-25159# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.

ELECTRON BEAM ANALYSIS OF THE PROPERTIES OF MOLECULAR AND ATOMIC OXYGEN IN THE AFFDL 2-FOOT ELECTROGASDYNAMICS FACILITY Final Report, 1 Jul. 1970 - 30 Nov. 1971

S. L. Petrie and J. J. Komar Wright-Patterson AFB, Ohio AFFDL Jan. 1973 79 p refs
(Contract F33615-70-C-1761; AF Proj. 1426)
(AD-759196; AFFDL-TR-73-10) Avail: NTIS CSCL 07/4

The electron beam fluorescence technique was used to

measure the vibrational temperature of molecular oxygen, the number density of molecular and atomic oxygen, and the rotational temperature of molecular nitrogen at the exit of the 19-inch conical nozzle of the Air Force Flight Dynamics Laboratory 2-Foot Electrogasdynamics Facility. Tests were conducted at reservoir pressures of 250, 350, and 500 psia with reservoir enthalpies varying from 2300 to 7200 Btu/lb. Theoretical results assuming finite rate chemical nonequilibrium were compared with the experimental data. At the 350 and 500 psia operating points, the theoretical results over-predict the O2/O concentration ratio while at the 250 psia point the theory underestimates the ratio. The rate of vibrational relaxation of molecular oxygen was found to be higher than that for molecular nitrogen with the O2 vibrational temperature relaxing only to 40% of the reservoir temperature. Possible causes for the discrepancies in the concentration data were examined. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-25160* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTRUDER DETECTION SYSTEM Patent
Robert D. Lee, inventor (to NASA) Issued 6 Mar. 1973 9 p Filed 12 Feb. 1971 Supersedes N72-21161 (10 - 12, p 1575) Continuation-in-part of US Patent Appl. SN-768662, filed 18 Oct. 1966
(NASA-Case-ARC-10097-2; US-Patent-3,719,891; US-Patent-Appl-SN-115083; US-Patent-Class-325-61; US-Patent-Class-325-45; US-Patent-Class-325-113; US-Patent-Class-340-207; US-Patent-Class-340-258R; US-Patent-Class-325-139; US-Patent-Appl-SN-768662) Avail: US Patent Office CSCL 17B

An intruder detection system is described. The system contains a transmitter which sends a frequency modulated and amplitude modulated signal to a remote receiver in response to a geophone detector which responds to seismic impulses created by the intruder. The signal makes it possible for an operator to determine the number of intruders and the manner of movement. P.N.F.

N73-25161* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CODE REGENERATIVE CLEAN-UP LOOP TRANSPONDER FOR A MU-TYPE RANGING SYSTEM Patent
William J. Hurd, inventor (to NASA) Issued 24 Apr. 1973 9 p Filed 8 Nov. 1971 Supersedes N72-20161 (10 - 11, p 1440) Sponsored by NASA
(NASA-Case-NPO-11707; US-Patent-3,729,736; US-Patent-Appl-SN-196399; US-Patent-Class-343-6.5R; US-Patent-Class-343-6.8R) Avail: US Patent Office CSCL 17B

A loop transponder for regenerating the code of a mu type ranging system is disclosed. It includes a phase locked loop, a code generator, and a loop detector. The function of the phase locked loop is to provide phase lock between a received component wk of the range signal and a replica rafter wk of the received component, provided by the code generator. The code generator also provides a replica of the next component rafter w(w+1). The loop detector responds to wk rafler wk and rafter w(k+1) to determine when the next component w(k+1) is received and controls the code generator to supply w(k+1) to the phase locked loop and to generate a replica rafter w(k+2) of the next component. Official Gazette of the U.S. Patent Office

N73-25162 Maryland Univ., College Park.
RESOLUTION IN FREQUENCY-MODULATED RADARS Ph.D. Thesis
Louis Mario Tozzi 1972 183 p
Avail: Univ. Microfilms Order No. 72-28878

The fundamental principles of frequency-modulated radar systems are developed in terms of a generic system. Several practical embodiments of radars and altimeters are reviewed which illustrate practical ways of extracting range and velocity information. The post-mixing spectrum resulting from the use of sine-wave, triangular, and sawtooth frequency modulation is derived in detail, and the spectra produced by both single and double-point targets are shown. Based on this analysis, triangular and sawtooth modulated systems are described which extract range and velocity information by observing individual post-mixing spectral lines, and a method is presented for determining the direction of motion of targets by observing the post-mixing signals produced by sawtooth modulation. This analysis is then extended to describe a technique for the suppression of range side lobes by using multiple modulation functions. Dissert. Abstr.

N73-25163 Polytechnic Inst. of Brooklyn, N.Y.
ADAPTIVE MAXIMUM LIKELIHOOD RECEIVER FOR DIGITAL COMMUNICATION CHANNELS Ph.D. Thesis
Keshoolal Bakhru 1972 169 p
Avail: Univ. Microfilms Order No. 72-28205

The specification and design of receivers is considered for digital data communication over channels where the rate of transmission is limited not only by the noise but also by the intersymbol interference. The approach taken to minimize the effects of both the intersymbol interference and noise has been from the decision-theory viewpoint with emphasis on the minimization of probability of error. A maximum likelihood receiver for binary data with additive Gaussian noise and intersymbol interference from L past as well as future symbols is proposed. Such a receiver is known to be optimum in the sense of minimum probability of error. The receiver contains nonlinear elements and generates the test statistics recursively. The decision is on overlapping blocks of length L symbols. The receiver uses a decision directed scheme to estimate the channel parameters and is therefore adaptable to channels with slowly varying parameters. The scheme is especially suited for cases where the interference is large but restricted to small L. Dissert. Abstr.

N73-25164# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
NBS FREQUENCY AND TIME BROADCAST SERVICES: RADIO STATIONS WWV, WWVH, WWVB, AND WWVL
Peter P. Viezbicke, ed. May 1973 19 p refs
(NBS Proj. 2730121)
(NBS-SP-236) Avail: SOD $0.45 Domestic Postpaid or $0.35 GPO Bookstore as C13.11:236

Detailed descriptions are given of the technical services provided by the National Bureau of Standards radio stations. These services are: (1) standard radio frequencies; (2) standard audio frequencies; (3) standard musical pitch; (4) standard time intervals; (5) time signals; (6) UTI corrections; and (7) official announcements. In order to provide users with the best possible services, occasional changes in broadcasting schedules are required. This publication shows the schedules in effect on January 1, 1973. Current data relating to standard frequencies and time signals are available monthly in the Time and Frequency Services Bulletin. Author

N73-25165 Purdue Univ., Lafayette, Ind.
THEORY AND APPLICATION OF DPCM AND COMPARISON OF DPCM WITH OTHER TIME PREDICTIVE TECHNIQUES Ph.D. Thesis
Joseph Edward Essman 1972 246 p
Avail: Univ. Microfilms Order No. 72-30888

Differential pulse code modulation systems are analyzed using total mean squared error as the measure of fidelity. The formulation of the total system error is done using sampled data and spectral techniques. Design formulae are obtained in terms of tangible system parameters such as sampling rates, quantizer levels, quantizer ranges, signal-to-noise, etc. The use of uniform and nonuniform quantization are considered. The formulae derived include the effects of channel errors when nonuniform quantization is used. Spectral densities for the various error terms in DPCM are obtained. The effects of channel errors using nonuniform quantizers are shown to result in an error spectral density which is not white. This result indicates the propagation of error in DPCM systems. Dissert. Abstr.

N73-25166 Delaware Univ., Newark.
MEASUREMENT OF PULSE PARAMETERS IN WIDEBAND RECEIVERS Ph.D. Thesis
John C. Murray, Jr. 1972 146 p
Avail: Univ. Microfilms Order No. 72-32010

The effect on the accuracy with which certain pulse parameters, amplitude, frequency, and time-of-arrival, can be measured, is considered for a class of receivers whose IF bandwidth may be an order of magnitude or more greater than the nominal bandwidth of the pulse-like signal. For the measurement of each of the three parameters, attention is focused on the dependence of the error in measuring the parameter on the amount by which the IF frequency of the signal is displaced, or detuned, from the center of the receiver IF amplifier pass band. In each case, the magnitude characteristic of the IF filter is assumed to be perfectly flat, so that the effect that is being investigated is due solely to the undesired signal x noise terms arising in the nonlinear action of the detection process. Results for the variances in the estimators of the three parameters are obtained, and their dependence on the ratio of IF-to-signal bandwidth, and amount of detuning, is discussed.
Dissert. Abstr.

N73-25167 Northwestern Univ., Evanston, Ill.
TRANSIENT ELECTROMAGNETIC FIELDS OF PULSE EXCITED WIRE AND APERTURE ANTENNAS Ph.D. Thesis
Anas Mohamed Abo-Zena 1972 155 p
Avail: Univ. Microfilms Order No. 72-32364

The transient electromagnetic behavior of wire and aperture antennas is analyzed. The circular loop antenna is used as an example of a wire antenna; the spherical antenna with a slot is used as an example of the finite surface antenna; and the wedge with an aperture in one side is used as an example of the infinite surface antenna. For a circular loop antenna, excited by a frequency-band-limited rectangular voltage pulse, the time variation of the electric field at remote points in various directions and at points at distances equal to three and six loop radii from the center of the loop is computed. For the sphere, the time variation of the radiation field due to pulse excitation at a circumferential gap is given for remote points in different directions. The periodic pulse approach which was used in treating loop antennas is used in obtaining the radiation field. In studying the transient field of a wedge, the time-dependent space-time impulse response, due to an instantaneous point source in the region of a wedge, is obtained. Dissert. Abstr.

N73-25168 Polytechnic Inst. of Brooklyn, N.Y.
FREQUENCY LOCKED LOOP FM DEMODULATOR Ph.D. Thesis
Nazif Tepedelenlioglu 1972 115 p
Avail: Univ. Microfilms Order No. 72-28298

The frequency locked loop FM demodulator (FLL) is a new kind of FM demodulator which is capable of suppressing the rapid frequency disturbances (spikes) which normally occur at the output of a conventional discriminator when a noisy FM signal is demodulated. The FLL does this by making use of the correlation between the envelope of the incoming signal plus noise and the occurrence of the spikes. The first order analog FLL is presented and analyzed. In the analysis, the noise at the output of a conventional discriminator is assumed to consist of two statistically independent terms; the Gaussian-like noise and the poisson distributed spike noise. The manner in which the FLL modifies these noise terms is investigated. Dissert. Abstr.

N73-25169 Alabama Univ., University.
A STUDY OF THE MAJOR SOURCES OF DISTORTION IN AM-BASEBAND TELEMETRY SYSTEMS AND TECHNIQUES FOR OPTIMUM BASEBAND DESIGN Ph.D. Thesis
William Earl Salter 1972 189 p
Avail: Univ. Microfilms Order No. 72-26336

The waveform distortion resulting from adjacent channel crosstalk, intermodulation and radio frequency (rf) noise, and from amplitude and phase nonlinearity in channel filters limits the minimum channel spacing, and hence the bandwidth utilization efficiency of amplitude modulation (AM) suppressed carrier telemetry systems. Specific mathematical models and formulas are developed for determining waveform distortion in such systems and the results are utilized in the design of systems with optimum performance. For more general waveguides it is suggested that the nonuniform waveguide may sometimes be approximated by a cascade of solvable nonuniform waveguides. The nature of the coupling between the various waveguide models lies in an understanding of the waveguide junction analysis. A junction analysis formulation is undertaken with approximations that allow the modal field expansions on both sides of the junction to be equated. Dissert. Abstr.

N73-25170 Newark Coll. of Engineering, N.J.
ELECTROMAGNETIC WAVE PROPAGATION IN NONUNIFORM WAVEGUIDES WITH PERFECT CONDUCTING WALLS Ph.D. Thesis
Irwin Share 1972 143 p
Avail: Univ. Microfilms Order No. 72-33126

The analysis of nonuniform waveguides is formulated in terms of non-orthogonal generalized coordinates by utilizing the Hertz vector potentials and the Riemann metric tensor. When the Hertz potential is expressible as a function of the propagation coordinate times a function of the transverse coordiates, then the nonuniform waveguide may be represented by transverse equations and a set of uncoupled nonuniform transmission lines. This decomposition facilitates studying propagation along the coordinate. Sufficient conditions to achieve this decomposition are investigated. It is demonstrated that these constraints may provide guide-lines for selecting a useful coordinate system to describe the nonuniform waveguide. In terms of this coordinate system the nonuniform waveguide analysis may be reduced to solving uncoupled nonuniform transmission lines if the eigenvalues of the transverse equations can be determined. This allows nonuniform transmission line theory to be applied to the study of certain nonuniform waveguides. Dissert. Abstr.

N73-25171 Auburn Univ., Ala.
FORMULATION OF RADAR GLINT TRACKING ERROR REDUCTION USING FREQUENCY AGILITY AND LINEAR AMPLITUDE WEIGHTING Ph.D. Thesis
Jester M. Loomis, III 1972 99 p
Avail: Univ. Microfilms Order No. 72-31361

Frequency agility is used to obtain independent samples of target position. The samples are then processed utilizing a linear weighting scheme which determines target position by the amplitude of the return signal. The simple method of choosing the target position corresponding to the echo-signal with the largest amplitudes is the most effective. This weighting method when applied to independent target returns reduces the rms tracking error substantially. The resulting reduction in rms tracking error is developed into an equation dependent upon the original glint tracking error, and the number of returns weighted. The rms tracking error and the instantaneous tracking error are reduced. The probability of receiving an erroneous aiming point, due to glint, that indicates a target's position to be outside the physical target's extent is required to less than 0.00001. Dissert. Abstr.

N73-25172*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK, VOLUME 15 Progress Report, Mar. - Apr. 1973
15 Jun. 1973 218 p refs
(Contract NAS7-100)
(NASA-CR-133032; JPL-TR-32-1526-Vol-15) Avail: NTIS HC $13.00 CSCL 17I

The DSN progress is reported in flight project support, TDA research and technology, network engineering, hardware and software implementation, and operations. Topics discussed include: DSN functions and facilities, planetary flight projects, tracking and ground-based navigation, communications, data processing, network control system, and deep space stations.
F.O.S.

N73-25173*# Stanford Research Inst., Menlo Park, Calif.
RESEARCH AND APPLICATIONS: ARTIFICIAL INTELLIGENCE Interim Scientific Report, 7 Oct. 1969 - 15 Apr. 1970
L. J. Chaitin, R. O. Duda, P. A. Johanson, B. Raphael, C. A. Rosen, and R. A. Yates Apr. 1970 165 p refs
(Contract NAS12-2221; ARPA Order 1058; SRI Proj. 8259)

(NASA-CR-132996) Avail: NTIS HC $10.25 CSCL 06D

The program is reported for developing techniques in artificial intelligence and their application to the control of mobile automatons for carrying out tasks autonomously. Visual scene analysis, short-term problem solving, and long-term problem solving are discussed along with the PDP-15 simulator, LISP-FORTRAN-MACRO interface, resolution strategies, and cost effectiveness. F.O.S.

N73-25174*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

OTV CAMERA REFERENCE HANDBOOK SKYLAB/ASTP

31 Jan. 1973 85 p

(NASA-TM-X-69526; KSC-GP-929A) Avail: NTIS HC $8.25 CSCL 09F

Definition is made of all television camera locations as well as the specific area to be covered by each camera to provide the television coverage of Skylab testing and launches in accordance with operational and engineering requirements. Author

N73-25175*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

VIRGINIA PRECIPITATION SCATTER EXPERIMENT: EXPERIMENT DESCRIPTION

Edward Levine (Computer Sciences Corp.), Robert K. Crane (MIT Lincoln Lab.), Paul Wells (Inst. for Telecommunication Sciences), and Francis X. Downey Aug. 1972 97 p refs

(NASA-TM-X-66259; X-750-73-54) Avail: NTIS HC $7.00 CSCL 17I

A year's statistical data were acquired for the purposed of refining existing coordination procedures for the sharing of common frequency allocations between terrestrial and space services. The measurement program was conducted between October 3, 1970 and October 2, 1971, to empirically determine the cumulative distributions of scattering cross section per unit volume of hydrometeors at heights up to 9 km above the surface and of rain rate at the surface. The measurements were made in southeastern Virginia using a bistatic, continuous-wave, vertically polarized radar system operating at S- and X-band frequencies and tipping-bucket rain gages. The bistatic radar system was configured to represent an interference situation between a radio-relay system and a space communication system Earth terminal; the results may be interpreted as measured distributions of transmission loss for interference due to rain. A description of the experiment and equipment is included. Author

N73-25176# Essex Univ., Colchester (England). Telecommunication Systems Group.

INVESTIGATION INTO ORTHOGONAL POLARISATION AT X BAND FREQUENCIES: 3RD YEAR PROGRESS REPORT 1970/71

A. J. Pryatt 1971 181 p

(Rept-53) Avail: NTIS HC $11.25

An investigation into the effect of precipitation on parabolic antennas employing linear orthogonal polarization at superhigh frequencies is presented. It was found that the effective bandwidth of a microwave link may be increased by transmitting two signals at the same frequency but of different polarizations. Alternatively, increased rejection of crosstalk between adjacent channels of a system may be achieved by transmitting the adjacent channels with different polarizations. Author

N73-25177# Essex Univ., Colchester (England). Dept. of Electrical Engineering Science.

TELECOMMUNICATION SWITCHING BY OPTICAL MEANS. THIRD INTERIM REPORT: SYSTEM IMPLICATIONS OF THE TECHNOLOGICAL STUDIES

K. W. Cattermole Apr. 1972 10 p

(Rept-61; IR-3) Avail: NTIS HC $3.00

The limitations to switching speed and capacity set by the physical properties of the electro-optical devices investigated are explored, and the switching configurations under study for single-channel and time-division-multiplex signals are described. The essence of the switching mechanism is that a beam of light, carrying the information as digital modulation, is deflected so as to impinge on a selected detector or output port. Author

N73-25178# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ATC SURVEILLANCE/COMMUNICATION ANALYSIS AND PLANNING Quarterly Technical Summary, 1 Dec. 1972 - 28 Feb. 1973

1 Mar. 1973 30 p refs

(Contracts DOT-FA72WAI-242; F19628-70-C-0230; FAA Proj. 022-243-012; FAA Proj. 033-241-062)

(FAA-RD-73-35) Avail: NTIS HC $3.50

FAA funded air traffic control Surveillance/Communication Analysis and Planning activities during the period 1 December 1972 to 28 February 1973 are reported. Status information is provided on the modification and preliminary testing of a demonstration ASR radar and its associated signal and display processing equipment. New approaches to rain clutter rejection and near-optimum receiver design are discussed. Author

N73-25179# Lockheed Missiles and Space Co., Palo Alto, Calif.

NONLINEAR FOLLOWING SYSTEMS AND THEIR ELEMENTS

G. V. Obrezkov and V. D. Razevig [1973] 20 p Transl. into ENGLISH from the book "Metody Analiza Sryva Slezheniia" Moscow, Sov. Radio, 1972 20 p

Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The operation of follower units in automatic radio tracking systems is studied by analyses of their block diagrams. Methods for forming the block diagrams are examined and their characteristics are evaluated for diverse automatic tracking systems. Block diagram elements considered are discriminators, filtering stages, control circuits, and the differential equations describing the behavior of tracking systems. G.G.

N73-25180*# New York Univ., N.Y. Geophysical Sciences Lab.

A HIGH FREQUENCY CORRECTION TO THE KIRCHHOFF APPROXIMATION, WITH APPLICATION TO ROUGH SURFACE EM WAVE SCATTERING

Frederick C. Jackson [1973] 41 p refs

(Contract NAS1-10090)

(NASA-CR-112263; TR-71-8) Avail: NTIS HC $4.25 CSCL 20N

A high frequency correction to the Kirchhoff approximation is developed for application to rough surface scattering. An approximate solution to the magnetic field integral equation for perfect conductivity and plane wave excitation yields a perturbed surface current expressed as a linear function of the second derivatives of surface height. The corrected surface current vector is substituted into the far field Stratton-Chu integral and average backscattered powers for the four polarization combinations are computed on the assumption that the surface is describable as a stationary Gaussian random process. The strength of this scattering solution is that it can account for height curvature correlation without requiring small height and slope. Author

N73-25181# Bureau of Meteorology, Canberra (Australia). Dept. of Science.

DIGITAL PROCESSING OF METEOROLOGICAL RADAR SIGNALS

D. Sirmans Australian Govt. Publ. Serv. Dec. 1972 60 p refs

(Meteorol-Study-25) Avail: NTIS HC $5.00

A signal processing technique is described which reduces the variance from return rain signals to acceptable levels for quantative measurements, using the log-power output from radar as the variable. Digital averaging techniques used to reduce the variance signal, the properties of resultant signals, and circuit analysis in various stages are outlined. Statistical and other properties of the output data are discussed. Author

N73-25182*# Martin Marietta Corp., Denver, Colo.

INVESTIGATE OPTIMUM WAY OF ADDING WIDEBAND CAPABILITY AND RECOMMEND A DESIGN FOR MODIFICATION OF ONE GOVERNMENT FURNISHED AM BASEBAND DEMULTIPLEXER Final Report

G. Hauge Apr. 1973 49 p refs

(Contract NAS8-29039)

(NASA-CR-124267; MCR-73-92) Avail: NTIS HC $4.50 CSCL

17B

The hardware design and implementation and test results are described of the accommodation of two wideband channels, 8 kHz DSB/QDSB located at 44 kHz and 16 kHz SSB, lower sideband, located at 104 kHz in a government furnished FDM demultiplexer unit. Author

N73-25183*# Denver Research Inst., Colo. Industrial Economics Div.

THE NASA ROLE IN MAJOR AREAS OF HUMAN CONCERN: COMMUNICATION

Feb. 1973 15 p refs

(Contract NASw-2362)

(NASA-CR-133052) Avail: NTIS HC $3.00 CSCL 17B

After introducing some of the general factors that have affected progress in the area of communication, NASA program elements are examined to illustrate relevant points of contact. Interpretive steps are taken throughout the report to show a few of the more important ways people's lives have been affected as a result of the work of NASA and other organizations functioning in this area. The principal documents used and interviews conducted are identified. Author

N73-25184# IIT Research Inst., Chicago, Ill.

AIRBORNE EUROPEAN RF MEASUREMENTS IN THE 100-500 MHz BAND

D. Madison, L. Kuehn, and T. Bode Nov. 1972 252 p

(Contract F19628-73-C-0031; AF Proj. 649E)

(AD-758772; ESD-TR-72-293) Avail: NTIS CSCL 20/14

The report contains a description of an airborne RF measurement project. Included is a discussion of the hardware used to obtain the measurements, a description of the computer algorithms used to control an automatic spectrum analyzer, a description of the basic raw data and a presentation of the results. The measurements were taken over West Germany and France in the 100 to 500 MHz band. The automatic spectrum analyzer was mounted in a KC-135 aircraft, and a log-periodic antenna was mounted under the nose of the plane. The measurements were taken during April, May, and June 1972, and a complete schedule is contained in the report. (Author Modified Abstract) GRA

N73-25185# Avco Corp., Wilmington, Mass.

AZIMUTHAL AND DIURNAL PROPERTIES OF HF BACKSCATTER Final Report

R. P. McConville, R. B. Penndorf, D. G. Detert, and A. S. Weeks Griffiss AFB, N. Y. RADC Jan. 1973 174 p refs

(Contract F30602-70-C-0083)

(AD-758776; RADC-TR-73-17) Avail: NTIS CSCL 20/14

The report presents the results of several experiments related to the azimuthal and diurnal dependence of HF backscatter and terrestrial radio noise and the nature of earth backscatter from regions near the skip zone and from sea water. The first experiment consisted of stepped azimuth panoramic backscatter soundings over a diurnal cycle. The sounding waveform was linear FM/CW with an average transmitted power of 5 kW. The second experiment explored the details of the sunrise and sunset transition periods along a fixed azimuth, also instrumented with an oblique-incidence forward-scatter FM/CW ionosonde and a co-located broadband repeater. The third experiment collected an azimuthal sample of terrestrial radio noise in the guard frequency band of WWV during the silent period. The fourth experiment considered some characteristics of the leading edge of the backscatter region from the point of view of illumination control and frequency management. Author (GRA)

N73-25186# California Univ., Berkeley. Space Sciences Lab.

TRANSFORMATION OF THE SPECTRUM OF A SIGNAL IN COMMUNICATION BETWEEN RELATIVISTICALLY MOVING INERTIAL FRAMES

Michael A. Morgan and Samuel Silver Mar. 1973 48 p refs

(Contract F44620-71-C-0087; AF Proj. 4751)

(AD-758851; SSL-Ser-14-Issue-15; AFOSR-73-0577TR) Avail: NTIS CSCL 17/2

Future space exploration may involve communications between space craft moving at relativistic velocities. One of the significant problems associated with such communication is spectral distortion of signals which are propagated between relativistic frames. This distortion is generated by both changing propagation distances and purely relativistic electromagnetic field transformations. In the paper a linear integral transformation is formulated for relating the Fourier spectra of the source antenna excitation current and the resulting incident electric field at the receiving antenna. The kernel of the transformation is evaluated for the case of a steerable source antenna tracking on the advanced receiver position. The transformation is then applied to the case of an ideal thin-wire half-wave dipole source antenna excited by a narrow-band D.S.B. modulated current. The specific distortions of spectral spreading and translation are then related to increased bandwidth and upper cutoff frequency requirements of receiving systems in relativistic applications. Author (GRA)

N73-25187# Teleconsult, Inc., Washington, D.C.

TOWARDS IMPROVING US-LATIN AMERICA TELECOMMUNICATIONS RELATIONS

Oct. 1972 230 p

(Contract OTP-SE-72-117)

(PB-214619/9; OTP-SP-12) Avail: NTIS HC $3.00 CSCL 17B

The present relationships between U.S. and Latin American telecommunication policy level institutions are reviewed. Appropriate initiatives for establishing substantive and continuing relations with institutions and individuals responsible for policies, regulations and International Telecommunication Union (ITU) relationships are recommended. GRA

N73-25188# Aerospace Corp., El Segundo, Calif.

THE MAGNETOSPHERE AS A COMMUNICATION MEDIUM AT VERY LOW FREQUENCIES Technical Report, Jan. 1971 - Nov. 1972

Harry C. Koons 28 Feb. 1973 29 p refs

(Contract F04701-72-C-0073)

(AD-759258; TR-0073(9220-01)-4; SAMSO-TR-73-140) Avail: NTIS CSCL 17/2

The potential exists for communications at very low frequencies (-30 kHz) from a satellite-borne transmitter to receivers with subsurface antennas. A calculation of the link margin must include plasma antenna effects, coupling to the whistler mode of propagation, ducting through the plasma medium, wave-particle interactions along the propagation path, transmission through the ionosphere, and finally coupling to the subsurface antenna through the earth-ionosphere wave guide. Propagation will also be characterized by multipath ducting in electron density troughs and gradient ducting by the plasmapause. The observational evidence for each of these phenomena is reviewed, and the physics of each is discussed with specific reference to the implications of each for a satellite-to-ground VLF communication link. (Author Modified Abstract) GRA

N73-25189# Pattern Analysis and Recognition Corp., Rome, N.Y.

TIME DOMAIN ANALYSIS FOR INVERSE SCATTERING. VOLUME 1: TIME DOMAIN ANALYSIS Final Report

John W. Sammon, Ronald M. Oelsligle, Paul Caruso, Donald H. Foley, and Leonard Bennett Nov. 1972 89 p refs

(Contract F30602-72-C-0227)

(AD-757564; PAR-72-28-Vol-1; RADC-TR-72-292-Vol-1) Avail: NTIS CSCL 09/4

The volume includes an analysis of waveform data representative of space objects. The purpose of this investigation was to define a set of features capable of performing discrimination. The work represented by the report addresses three problem areas. Volumes 2 and 3 involve the extraction and definition of patterns for the eventual design of a logic. This logic will provide the capability of discriminating target classes within data collected from acoustic and magnetic sensors respectively. In each case, a small data base was used to define a preliminary logic. Author (GRA)

N73-25190# Pattern Analysis and Recognition Corp., Rome, N.Y.

TIME DOMAIN ANALYSIS FOR INVERSE SCATTERING. VOLUME 2: ACOUSTIC SIGNATURE ANALYSIS Final Report

John W. Sammon, Ronald M. Oelsligle, Paul Caruso, Donald H. Foley, and Leonard Bennett Nov. 1972 74 p refs

(Contract F30602-72-C-0227)
(AD-757538; PAR-72-28-Vol-2; RADC-TR-72-292-Vol-2) Avail: NTIS CSCL 09/4

The report describes a six-month effort leading to: (1) the preliminary software design of an acoustic classifier for the automatic recognition of targets, and (2) the development of an interactive data display and analysis facility for the rapid analysis of future data bases. GRA

N73-25191# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN EXPERIMENTAL UHF GROUND SURVEILLANCE RADAR, VOLUME 2
Lincoln Cartledge and Robert D. Yates 12 Oct. 1972 77 p refs
(Contract F19628-73-C-0002; ARPA Order 1559)
(AD-757565; TR-497-Vol-2; ESD-TR-72-242-Vol-2) Avail: NTIS CSCL 17/9

The volume describes the use of the radar as a measurements system for studying targets and the clutter environment, in addition to its use for demonstrating the feasibility of radar detection of walking men in foliage. Investigations of target return spectra, clutter return spectra, and clutter return amplitude statistics are reported. Theoretical models relating clutter return spectra, and clutter return amplitude statistics are reported. Theoretical models relating clutter spectra to wind turbulence and tree resonances are presented and compared with experimental results. Similarly, a previous theoretical prediction of target return spectra is compared with experimental results. Clutter return amplitude statistics are measured and found to be Gaussian under certain conditions. Finally, the volume contains some comments on the relationships between the subclutter visibility and various parameters of digital MTI systems. (Author Modified Abstract) GRA

N73-25192# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
IDENTIFICATION OF THREE-DIMENSIONAL OBJECTS USING FOURIER DESCRIPTORS OF THE BOUNDARY CURVE
C. W. Richard, Jr. and H. Hemani Aug. 1972 15 p refs Submitted for publication
(Grant AF-AFOSR-2048-71; AF Proj. 9769)
(AD-758895; AFOSR-73-0610TR) Avail: NTIS CSCL 09/4

The paper demonstrates the feasibility of a method for identification of a three-dimensional object from information contained in the boundary of its silhouettes. A silhouette is characterized by parametric representation of its boundary curve in the complex plane. After normalization and transformation, a set of Fourier descriptors is derived for every silhouette. A minimum distance classifier uses the descriptors to identify the three-dimensional object and to estimate its position and attitude with respect to a known reference coordinate system. The method was tested for identification of four aircraft representing complex and non-convex objects. Simulation results, quantitative and statistical, are presented. Author (GRA)

N73-25193# Naval Postgraduate School, Monterey, Calif.
A SAMPLE AND HOLD TECHNIQUE FOR AUTOMATIC FREQUENCY CONTROL IN BINARY DATA TRANSMISSION SYSTEMS M.S. Thesis
Erasmo Zorrilla Trisano Dec. 1972 39 p refs
(AD-758686) Avail: NTIS CSCL 17/2

A method of driving a voltage for automatic frequency control of a radioteletype receiver-converter is developed and tested. By sampling and holding the amplitude of the Mark and Space signals out of an FSK detector, comparing and integrating their difference, an error correcting voltage results which is less sensitive to noise and selective fading than the AFC voltage derived in the usual way. A sample-and-hold circuit is described. Comparative performance tests, with data in the form of strip-chart recordings, confirms the claims made for the technique. Author (GRA)

N73-25194# RHG Electronics Lab., Inc., Farmingdale, N.Y.
C BAND RECON DATA TRANSMISSION SYSTEM Final Technical Report, 30 Jul. 1971 - 30 Jun. 1972
Theodore W. Stone Wright-Patterson AFB, Ohio AFAL Nov. 1972 41 p
(Contract F33615-72-C-1003)
(AD-759184; FP-5-721; AFAL-TR-72-358) Avail: NTIS CSCL 17/2

The design and evaluation of a C band airborne recon data transmission system consisting of an airborne 20 Watt FM transmitter and a ground receiver is presented. The equipment transmits video signals with a baseband of 3.5 MHz from an aircraft to a ground station. The transmitter operates at one of three selectable channels in the 4.4 to 4.8 GHz band, and the receiver is continuously tuneable over this range. The system signal to noise performance is presented, and several of the problems encountered in this design are discussed. Author (GRA)

N73-25195# ITT Electro-Physics Labs., Inc., Columbia, Md.
TEAL WING OWR (OVER WATER RESEARCH) PROGRAM Semiannual Technical Report, period ending 30 Mar. 1973
Robert B. Wagner 1 Apr. 1973 60 p
(Contract N00014-72-C-0441; ARPA Order 2078)
(AD-759033; Rept-229) Avail: NTIS CSCL 17/2

Progress, to date of report, consists primarily of preparation of equipment and procedures for collecting and processing data as to broadband atmospheric noise in the upper MF-lower HF portion of the frequency spectrum. (Progress on two other tasks of later scheduling not stressed.) Some equipment details and photographs are included. Equipment was readied for shipboard measurements in the North Atlantic in early April, late June and in winter circumstances. Processing is to be done off-line from taped digital data. Both omnidirectional and limited directional (azimuthal statistics) data will be collected. Radiometer techniques are used in the latter. Author (GRA)

N73-25196# Army Electronics Command, Fort Monmouth, N.J.
SINGLE STATION OF AN ELECTROMAGNETIC WAVE AFTER REFLECTION BY A TILTED PLANE OR SINUSOIDAL IONOSPHERE: A PRELIMINARY REPORT
Leon Kotin Apr. 1973 18 p
(AD-759488; ECOM-4103) Avail: NTIS CSCL 17/3

The author determines mathematically the source of an electromagnetic signal originating at some unknown point on the earth's planar surface after being reflected from the ionosphere. Two cases are considered; first, the signal is reflected by a tilted plane, representing the boundary of the ionosphere; second, the signal is reflected by a sinusoidal surface. The parameters describing either of these surfaces are assumed to have been determinad by ionospheric probes and the direction of the reflected signal is assumed to have been determined by direction finding techniques. Author (GRA)

N73-25197# Alabama Univ., Huntsville.
USER'S MANUAL FOR EAR (EXPERIMENTAL ARRAY RADAR) SIMULATION PROGRAMS Interim Technical Report, Jul. 1972 - Feb. 1973
Robert J. Polge and Roy D. Hays Feb. 1973 43 p refs
(Contract DAAH01-71-C-1181; DA Proj. 1M2-62303-A-214)
(AD-758922; UAH-RR-139) Avail: NTIS CSCL 15/3

The report contains the information required by the user for execution and interpretation of the Experimental Array Radar (EAR) system simulation programs. It includes a glossary of program variables, as well as the computer program listings. This user's manual report supplements the EAR System Simulation Studies interim technical report dated July 1972. Author (GRA)

N73-25198# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
HARMONIC GENERATION IN AN ELECTROMAGNETIC WAVE
R. Venkataraman and R. S. Rivlin Feb. 1973 36 p refs
(Contract DAAD05-69-C-0053; Themis Proj. 65)
(AD-758911; CAM-110-27; BRL-CR-89) Avail: NTIS CSCL 20/14

A plane electromagnetic wave is propagated in a non-linear non-dissipative isotropic dielectric. A method is given for the calculation of the change in the amplitudes and phases of harmonics of all orders, as the wave progresses, for any specified dependence of the dielectric constant on the magnitude of the

electric field and for any initial wave form. The calculations are valid provided the distance of travel is sufficiently small that shocks are not formed. The formulae for the amplitudes and phases of the various harmonics take a particularly simple form when the initial wave-form is sinusoidal and the non-linearity of the dielectric is not too great. (Author Modified Abstract) GRA

N73-25199# Naval Research Lab., Washington, D.C.
MAGIC MODE: INVESTIGATIONS OF ARTIFICIAL STIMULATION OF ULF WAVES IN THE IONOSPHERE AND MAGNETOSPHERE Final Report
John R. Davis, John W. Willis, and Edwin L. Althouse 12 Mar. 1973 49 p refs
(RF21222401)
(AD-759012; NRL-7552) Avail: NTIS CSCL 17/2

The report describes an investigation of the potential usefulness of the ultra-low-frequency (ULF) band for communications with deeply submerged reception terminals. The discussion begins with a comprehensive review of present knowledge about ULF propagation. Present understanding of ULF propagation modes (based on observations of naturally occurring geomagnetic micropulsations) is summarized, and those features which are of importance to potential communications systems are discussed. Emphasis is then placed on the study of potential ULF generation mechanisms between 0.2 and 5 Hz which would benefit from the naturally occurring magnetospheric amplification process that is observed to occur in that frequency band. Two possible source regions are considered for the artificial generation of ULF waves; the ionospheric dynamo and the magnetospheric proton belt. (Author Modified Abstract) GRA

N73-25200# Naval Electronics Lab. Center, San Diego, Calif.
HF COMMUNICATIONS IMPROVEMENT FOR NAVAL AIRCRAFT Research and Development Report, Jul. 1971 - Sep. 1972
J. M. Horn 2 Jan. 1973 24 p refs
(NAVAIR Proj. W-3243; NELC Proj. B705)
(AD-759709; NELC-TR-1857) Avail: NTIS CSCL 09/5

Research pinpoints techniques that promise improvement in aircraft hf communication system design. Approaches discussed in the report include: adaptive hf antenna array inducing antijam, miniature passive and active antenna elements, adaptive phase equalization/predetection combining, polarization diversity, mode averaging diversity combiner, and antenna mathematical modeling techniques. Two techniques show promise for diversity reception -Villard mode averaging and predetection/phase equalization combining. Improved aircraft antenna systems are the key to improved aircraft communications. Mathematical modeling shows promise for designing aircraft antennas. Hf adaptive antennas may be feasible for both beam and null steering. Author (GRA)

N73-25201# Army Foreign Science and Technology Center, Charlottesville, Va.
IMPROVEMENT OF A SYSTEM FOR MEASURING THE INTENSITY OF RADIO ECHOES OF METEOROLOGIC RADAR
F. Burdakov 14 Mar. 1973 11 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 217, 1967 p 105-111
(AD-759759; FSTC-HT-23-1720-72) Avail: NTIS CSCL 04/2

The paper considers aspects of quantitative measurement of the radio-echo from meteorological formations and describes improvements in a meteorological radar (MRL) iso-echo system. Author (GRA)

N73-25202# Army Foreign Science and Technology Center, Charlottesville, Va.
GEODETIC PHASE RANGE ONLY RADAR LUCH
A. A. Genike 31 Oct. 1972 9 p Transl. into ENGLISH from Geodeziya Kartografiya (USSR), no. 10, 1969 p 15-20
(AD-759756; FSTC-HT-23-984-72) Avail: NTIS CSCL 17/9

The report describes the phase range only radar Luch which contains several substantial technological improvements over previous such range finders. Its stations are lighter, transportable, interchangeable, more accurate, and easier to use. Author (GRA)

N73-25203# Concord Research Corp., Burlington, Mass.
SOVIET MICROPULSATIONS RESEARCH FOR POSSIBLE COMMUNICATIONS APPLICATION
James G. Beitchman 21 Feb. 1973 81 p refs
(Contract DAAH01-72-C-1013; ARPA Order 2225)
(AD-759380; CRC-16) Avail: NTIS CSCL 17/2

The report reviews the fundamentals of high frequency geomagnetic micropulsations in the region of the electromagnetic spectrum from about 1-5 Hz. It then discusses, by reviewing the open literature, the large body of research performed in this discipline by Soviet scientists. Conclusions are not made as to whether or not the results of these investigations are, in fact, being applied towards functional communications systems. It is, however, demonstrated that the Soviet research is applicable and necessary to the possible future use of micropulsation modes for communications purposes. Author (GRA)

N73-25204# Goodyear Aerospace Corp., Akron, Ohio.
COORDINATE DETERMINATION OF SLAR (SIDE LOOKING AIRBORNE RADAR) IMAGED FEATURES
R. Kause, J. A. Thomas, and T. E. Jeffrey (Army Res. Inst. for the Behavioral and Social Sci.) Apr. 1973 41 p refs
(Contract DAHC19-67-C-0051; DA Proj. 2Q6-62704-A-721)
(AD-759495; ARI-TRN-234) Avail: NTIS CSCL 17/9

In a joint effort, personnel of the Goodyear Aerospace Corporation and of the Army Research Institute (ARI) conducted research to improve the performance of operators in interpreting SLAR (side-looking airborne radar) imagery in real-time or near real-time inflight display systems. The principal objective of the experimental study was to determine the precision with which image interpreters can determine the coordinate location of targets detected on a near real-time SLAR display or in a simulated situation. (Author Modified Abstract) GRA

N73-25205# Florida Univ., Gainesville. Communication Sciences Lab.
THE SPEECH CHARACTERISTICS OF DIVERS IN HeO2 BREATHING MIXTURES AT HIGH PRESSURE
Harry Hollien, Howard B. Rothman, Stephen H. Feinstein, and Patricia Hollien 1 Feb. 1973 14 p
(Contract N00014-68-A-0173-0008; NR Proj. 196-114)
(AD-759413; CSL/ONR-TR-49) Avail: NTIS CSCL 17/2

The development of saturation diving has created problems in speech communication due to the effects of breathing HeO2 gas mixtures at high ambient pressures. A series of experiments is described that relate the distorting effects of the HeO2/P environment to: intelligibility levels, phonemic confusions, non-linearity of vowel format shifts, speech adaptation over time, and speech modification techniques to improve intelligibility. The research demonstrates that the intelligibility of a diver's speech under HeO2/P conditions improves over time. Author (GRA)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-25206* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NUMERICAL COMPUTER PERIPHERAL INTERACTIVE DEVICE WITH MANUAL CONTROLS Patent
Arthur I. Zygielbaum and Stanley S. Brokl, inventors (to NASA) Issued 24 Apr. 1973 5 p Filed 22 Jun. 1971 Supersedes N72-11208 (10 - 02, p 0176) Sponsored by NASA
(NASA-Case-NPO-11497; US-Patent-3,729,129;
US-Patent-Appl-SN-155565; US-Patent-Class-235-10.2;
US-Patent-Class-235-92R; US-Patent-Class-235-92CV;
US-Patent-Class-235-92EV; US-Patent-Class-235-92EA;
US-Patent-Class-235-151.27; US-Patent-Class-235-92DN)
Avail: US Patent Office CSCL 09B

A computer peripheral device is disclosed which includes a joystick whose displacement from a counter position along two axes X and Y in either a plus (+) or a minus (-) direction is sensed. The displacement magnitude in either direction controls the rate of clock pulses provided by a variable frequency clock.

The clock pulses from the two clocks are accumulated in two separate counters, whose contents are displayed. The contents of the counters are suppliable to a computer to update the contents of specific cells which define the position of a cursor on a display which is under computer control.
Official Gazette of the U.S. Patent Office

N73-25207 Duke Univ., Durham, N.C.
STUDY OF A NON-STATIONARY SPACECRAFT DATA CHANNEL Ph.D Thesis
Sidney Lloyd Kauffman 1972 176 p
Avail: Univ. Microfilms Order No. 72-31575

A system is developed for estimating the SNR of satellites employing pulse frequency modulation (PFM), using a small computer (PDP-8/1) for data acquisition and analysis. It is shown that a close approximation of an ideal low-pass filter is desirable in estimating the channel SNR. The design approach for this filter introduces the concept of a hybrid filter, where some of the poles are realized in the analog domain, and the remainder digitally. This approach yields several benefits, including better analog-to-digital converter resolution, reduced aliasing effects, and higher order filter realizations than are practical with either analog or digital filters. Dissert. Abstr.

N73-25208# Lockheed Missiles and Space Co., Palo Alto, Calif.
FUNDAMENTAL CHARACTERISTICS OF ON-BOARD DIGITAL COMPUTERS AND CONVERTERS
M. S. Khitrik, ed. and S. M. Fedorov, ed. [1973] 14 p Transl. into ENGLISH from the book "Dinamika Sistem Upravleniia Raket s Bortovymi Tsifrovymi Vychislitelnymi Mashinami" Moscow, Mashinostro., 1972 p 46-62
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

An onboard digital computer is discussed in terms of its function as the central element of a missile control system. As such detailed analysis is made of its interactions with onboard systems and ground based operations, relative to rate of calculation, structural characteristics of the storage unit, its reliability, weight, and size. Diagrams of the analog to digital conversion process are also presented which pertain specifically to time quantization, level quantization, and coding. J.M.M.

N73-25209# Rome Air Development Center, Griffiss AFB, N.Y.
AN ANALYSIS OF ASSOCIATIVE PROCESSING METHODS IN DATA MANAGEMENT
Casper R. Defiore Sep. 1972 210 p refs
(RADC Order 55500114)
(AD-750147; RADC-TR-72-248; Rept-73-01192) Avail: NTIS HC $12.50 CSCL 09/2

An associative approach to data management is described and a methodology for measuring the performance and effectiveness of this approach is provided. A test model data management system based on the associative approach, and implemented on a hardware associative memory is described. It is a display oriented on-line data management system implemented to demonstrate the feasibility and validity of the Associative system. Using Information Systems for Associative Memories (IFAM) it is easy for a user to rapidly achieve operational capability with a data base designed to fit his requirements. Comparisons between IFAM and an operational current system verify that the associative system out-performs current systems Author

N73-25210*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DIGITAL SIMULATION OF THE SERPENTUATOR USING MARSYAS
Sudarshan Singh, P. Washington Jun. 1973 55 p refs
(NASA-TR-R-414; M-543) Avail: NTIS HC $3.00 CSCL 09B

Serpentuator is a serpentine teleoperator device for intravehicular and extravehicular activities in space. The serpentuator is simulated using simulation software system MARSYAS and using the Component-Connection Simulation model and the Direct Simulation model. A comparison of the results for the two cases shows that under identical conditions, simulation execution time in the Component-Connection model case is reduced by a factor of the order of 100. A visual display of the serpentuator positions is obtained using the AMTRAN system on the Datacraft DC 6024 computer. Author

N73-25211*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
TOP DOWN, BOTTOM UP STRUCTURED PROGRAMMING AND PROGRAM STRUCTURING
M. Hamilton and S. Zeldin Dec. 1972 99 p refs
(Contract NAS9-4065; DSR Proj. 55-23890)
(NASA-CR-128971; E-2728-Rev-1) Avail: NTIS HC $7.00 CSCL 09B

New design and programming techniques for shuttle software. Based on previous Apollo experience, recommendations are made to apply top-down structured programming techniques to shuttle software. New software verification techniques for large software systems are recommended. HAL, the higher order language selected for the shuttle flight code, is discussed and found to be adequate for implementing these techniques. Recommendations are made to apply the workable combination of top-down, bottom-up methods in the management of shuttle software. Program structuring is discussed relevant to both programming and management techniques. Author

N73-25212# Mitre Corp., Bedford, Mass.
PERFORMANCE MEASUREMENT WITHIN THE HIS SERIES 6000
H. R. Grodsky L. G. Hanscom Field, Mass. ESD Apr. 1973 50 p refs
(Contract F19628-73-C-0001; AF Proj. 572F)
(AD-759808; MTR-2476; ESD-TR-73-119) Avail: NTIS CSCL 09/2

The paper describes the currently obtainable measurements that can be used to analyze the performance of Honeywell Information System (HIS Series 6000 computer systems). The measurements include those describing the operation of application programs; these are available from standard system accounting data. Also identified are the measurements describing operating system response, use of system resources, and specific detailed program behavior. These are presented in descriptions of various software monitors developed within HIS. Management procedures for obtaining economic and efficient performance of a WWMCCS ADPE installation is also described herein. (Author Modified Abstract) GRA

N73-25213# Logicon, Inc., San Pedro, Calif.
SOFTWARE VALIDATION STUDY Final Report, 1 Jun. - 28 Dec. 1972
Jan C. Bartlett, Stuart G. Farnum, and Paul D. Samson Mar. 1973 140 p refs
(Contract F04701-72-C-0369; AF Proj. 3176)
(AD-759263; DS-72210-R1370; SAMSO-TR-73-105) Avail: NTIS CSCL 09/2

The objective of the Software Validation Study was to analyze the effectiveness of the development and testing process as it existed on a current ballistic system software development. For this case study, a Minuteman flight program R-D development, Flight Program 2, was examined. The report includes a description of the software development process, identification of project requirements and their sources, discussion of the testing process, and evaluation of these to identify areas for software technology development for future systems. Author (GRA)

N73-25214# Stanford Univ., Calif. Electronics Labs.
PDP-8 COMPUTER INTERFACES FOR TROPOSPHERIC PROPAGATION MEASUREMENTS
James E. Crapuchettes Mar. 1973 90 p refs
(Contract N00014-67-A-0112-0044)
(AD-759700; SU-SEL-73-007; TR-4506-1) Avail: NTIS CSCL 09/2

Interfaces for a PDP-8 computer used in tropospheric propagation research have been developed to provide communication with and control over the real-time radio equipment. The report describes the work and that was done on these interfaces and provides an understanding of their operation. The characteristics of the Input/Output bus of the PDP-8 computer and the digital circuit modules used in the implementation of the interfaces are provided as background for the discussions of the interfaces. Each of the interfaces is described with at least three sections:

a general description of its function, a specific description of the Input/Output commands used by it and the functions they perform, and a discussion of the interface as it is implemented. (Author Modified Abstract) GRA

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-25215 National Lending Library for Science and Technology, Boston Spa (England).
REDUCING THE SCANNING NONUNIFORMITY IN TV TRANSMITTER TUBES
L. P. Turchenko 1973 8 p refs Transl. into ENGLISH from Tekh. Kino i Tele. (USSR), v. 11, 1971 p 52-55
(NLL-DRIC-Trans-2758-(3623.66)) Avail: Natl. Lending Library, Boston, Spa, Engl.: 1 NLL photocopy coupon

Methods for correcting the nonuniformity of the beam velocity in camera tubes operating in a single-line mode are described. A distinguishing feature of this mode of operation is that scanning is done along a single line. The number of control parameters in the scanning generator is greatly reduced, since there is no necessity to correct the nonuniformity of the beam velocity over the entire frame. Mathematical models are included to describe the relationships involved in camera tube operation. Author

N73-25216 Northwestern Univ., Evanston, Ill.
MICROWAVE ACOUSTIC TRANSDUCERS Ph.D. Thesis
Kan Chou 1972 84 p
Avail: Univ. Microfilms Order No. 72-32406

A method of approach is provided by which the principal source of loss appearing in present microwave acoustic transducers can be eliminated. A historical examination of the development of microwave transducers was made to find out what are the major obstacles for achieving low loss energy conversion. Then the transducer with thin film perturbed reentrant cavity configuration is introduced for generating and detecting longitudinal acoustic waves in solids. The theory of the thin film perturbed cavity transducer is developed from the Green's function solution to the one-dimensional electroacoustic equation. By using the cavity configuration, the dissipation losses associated with the electrodes and the matching problems appearing in current sandwich structures can be eliminated. Dissert. Abstr.

N73-25217 New Mexico Univ., Albuquerque.
THE FABRICATION AND EXPERIMENTAL ANALYSIS OF METAL-INSULATOR-SEMICONDUCTOR DEVICES FOR RADIATION VULNERABILITY STUDIES Ph.D. Thesis
Thomas Allen Williamson 1972 273 p
Avail: Univ. Microfilms Order No. 72-30767

In concept, the construction of an MIS capacitor is simple, but the actual fabrication of experiment devices from which repeatable data can be obtained is more difficult. In this project, procedures were developed for constructing useful MIS capacitors. A variety of devices thus constructed were then subjected to measurements of their small signal (differential) capacitance and conductance. An analysis procedure was developed for deriving from the measured data the desired information regarding the insulator charge and interface conditions. Both capacitance-voltage and conductance-frequency analyses were developed, the former using no a priori knowledge of the semiconductor's resistivity or its doping profile, the latter incorporating three conductance models and corrections for losses in the gate-insulator and semiconductor bulk regions. Dissert. Abstr.

N73-25218 California Inst. of Tech., Pasadena.
FUNDAMENTAL LIMITATIONS IN MICROELECTRONICS, 1. POWER SCHOTTKY DIODE DESIGN AND COMPARISON WITH THE JUNCTION DIODE, 2. PERMITTIVITY OF STRONTIUM TITANATE, 3 Ph.D. Thesis
Bruce Hoeneisen Frost 1972 135 p
Avail: Univ. Microfilms Order No. 72-30804

The physical phenomena which ultimately limit the packing density of planar bipolar and MOS integrated circuits are examined. The maximum packing density is obtained by minimizing the supply voltage and the size of the devices. The Schottky diode design is developed and the characteristics of an optimally designed silicon Schottky diode are summarized. Measurements of permittivity of perovskite strontium titanate are interpreted as a function of orientation, temperature, electric field and frequency. The free energy of the crystal is calculated as a function of polarization. Dissert. Abstr.

N73-25219*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FURLABLE SPACECRAFT ANTENNA DEVELOPMENT Interim Report
R. E. Oliver and A. H. Wilson 15 May 1973 34 p refs
(Contract NAS7-100)
(NASA-CR-132989; IR-2; JPL-TM-33-606) Avail: NTIS HC $3.75 CSCL 17B

Recent activities at JPL directed toward the development of large furlable spacecraft antennas using conical main reflectors are described. Development of two basic antenna configurations conceived at JPL and utilizing conical main reflectors was pursued. A 4.3-m (14-ft)-diameter model based on the two-reflection conical-Gregorian concept and a 1.8-m (6-ft)-diameter model based on the four-reflection Quadreflex concept have been made and RF-tested. RF gain measurements for the 4.3-m 14-ft)-diameter conical-Gregorian model were 48.83 db at X-band (8.448 GHz) and 37.82 db at S-band (2.297 GHz). These gains correspond to efficiencies of 53.6 and 57.5%, respectively. RF gain measurements for the 1.8-m (6-ft)-diameter Quadreflex model were 47.59 db at Ku-band (16.33 GHz) and 41.30 db at X-band (8.448 GHz), corresponding to efficiencies of 58.6 and 51.5%, respectively. Author

N73-25220*# North Star Research and Development Inst., Minneapolis, Minn.
RESEARCH INTO THE FEASIBILITY OF METAL- AND OXIDE-FILM CAPACITORS Final Technical Report, May 1971 - Dec. 1972
G. V. Jorgenson and H. W. Larson Jun. 1973 40 p refs
(Contract NAS3-14373)
(NASA-CR-121165; W-268-73-1) Avail: NTIS HC $4.00 CSCL 09A

Thin film capacitors with up to twenty-two active layers have been deposited by RF sputtering. The materials were aluminum electrodes of 1200 to 1500 angstrom thickness and silica dielectric layers of 3000 to 6000 angstrom thickness. The best electrical characteristics were capacitances of nearly 0.1 microfarad for an active area of 1.25 square centimeters, dissipation factor of less than 0.01 over a frequency range of 0.5 to 100 kilohertz and energy density of approximately 70 millijoules per cubic centimeter of active deposited material at a working voltage of 40 volts. These aluminum-silica capacitors exhibit excellent electrical stability over a temperature range from -55 C to +300 C. Author

N73-25221*# Westinghouse Electric Corp., Youngwood, Pa. Semiconductor Div.
HIGH VOLTAGE AND CURRENT, GATE ASSISTED, TURN-OFF THYRISTOR DEVELOPMENT Final Report
T. P. Nowalk, J. B. Brewster, and Y. C. Kao 31 Dec. 1972 107 p refs
(Contract NAS3-14394)
(NASA-CR-121161) Avail: NTIS HC $7.50 CSCL 09A

An improved high speed power switch with unique turn-off capability was developed. This gate assisted turn-off thyristor (GATT) was rated 1000 volts and 100 amperes with turn-off times of 2 microseconds. Fifty units were delivered for evaluation. In addition, test circuits designed to relate to the series inverter application were built and demonstrated. In the course of this work it was determined that the basic device design is adequate to meet the static characteristics and dynamic turn-off specification. It was further determined that the turn-on specification is critically dependent on the gate drive circuit due to the distributive nature of the cathode-gate geometry. Future work should emphasize design modifications which reduce the gate current

required for fast turn-on, thereby opening the way to higher power (current) devices. Author

N73-25222# Dayton Univ. Research Inst., Ohio.
RESEARCH TO INVESTIGATE THE AGING CHARACTERISTICS OF SAMARIUM COBALT MAGNETS Semiannual Interim Technical Report, 15 Jun. - 31 Dec. 1972
Herbert F. Mildrum and Karl J. Strnat Wright-Patterson AFB, Ohio AFML Mar. 1973 53 p refs
(Contract F33615-72-C-1795; AF Proj. 7367)
(AD-758806; UDRI-TR-73-11; AFML-TR-73-46) Avail: NTIS CSCL 09/1

A program of experimental work is outlined which is aimed at testing the stability of commercially produced, sintered SmCo5 permanent magnets. The types of environmental exposure tests planned, the test procedures chosen and the magnetic measuring techniques selected are explained and the choices justified. The measuring equipment, several specially designed test fixtures and the testing laboratory in general are described and depicted. Instrument calibration, specific test procedures and some special measurement problems encountered are discussed. Test sample selection, status of magnet procurement, sample allotment to specific tests, etc., are reported. (Author Modified Abstract) GRA

N73-25223# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
MICROELECTRONIC INTERCONNECTION BONDING WITH RIBBON WIRE Final Report, 1 Jun. 1971 - 31 May 1972
H. K. Kessler and A. H. Sher Apr. 1973 35 p refs
(ARPA Order 1889)
(AD-758981; NBS-TN-767) Avail: NTIS MF $1.45; SOD HC $0.50 Domestic Postpaid or $0.35 GPO Bookstore as C13.46: 767 CSCL 09/1

The feasiblity of using aluminum ribbon wire for ultrasonic bonding of semiconductor microelectronic interconnections was studied, and several advantages over the use of round wire of equivalent cross-sectional area were found. Ribbon wire bonds exhibited little deformation or heel damage, and a greater percentage of bonds of a certain quality (as judged by pull strength and appearance) could be made over much greater ranges of the bonding machine parameters, time and tool tip displacement, using ribbon wire than was possible with round wire. The ease of positioning ribbon wire was indicated by making multiple ribbon wire bonds side-by-side on a 5-mil square pad, or by stacking up to four bonds one on top of another. However, bonding with harder than normal wire, previously thought to offer certain advantages with respect to higher bond tensile strength, yielded inconsistent results. Author (GRA)

N73-25224# Raytheon Co., Waltham, Mass. Research Div.
FERRITES FOR LOW COST PHASE SHIFTERS Semiannual Technical Report, 1 Jul. - 31 Dec. 1972
H. J. VanHook and J. J. Green Apr. 1973 42 p refs
(Contract DAAB07-71-C-0174)
(AD-758919; S-1533; ECOM-0174-3) Avail: NTIS CSCL 09/5

Polycrystalline Bi-Ca-V garnets have been produced, by conventional ceramic processing and firing, with microwave loss characteristics and hysteresis loop properties of H sub c = 1 Oe and 4 pi M sub r = 400 G for a composition having 4 pi M sub s = 600 G. This material has proven to be rather stress sensitive and a parallel program has begun to find minor substitutions which reduce magnetostriction. Nickel is only slightly soluble in Calvanbig, Ni = 0.01 to 0.02 per formula unit, and has a marginal effect on magnetostriction and anisotropy. Substitution of Eu and Ru have stronger effects on the anisotropy properties but also increase FMR linewidth. Author (GRA)

N73-25225# Purdue Univ., Lafayette, Ind.
CONTINUOUS FILTER MATHEMATICAL CONCEPTS, VOLUME 1
Benjamin J. Leon Griffiss AFB, N. Y. RADC Dec. 1972 69 p ref 2 Vol.
(Contract F30602-72-C-0105)
(AD-757544; RADC-TR-72-311-Vol-1) Avail: NTIS CSCL 09/5

Continuous or analog filters are electronic circuits assembled from resistors, inductors, capacitors, transistors, operational amplifiers, and other similar linear electronic circuit components. Such circuits are characterized by linear differential equations with constant coefficients. In the report, simple circuit concepts and simple mathematical concepts are tied together through the analysis of an RC lowpass filter and of a simple tuned circuit. These mathematical and circuit theoretic ideas are then generalized to any linear network. Two topics of special interest to circuit designers, the use of impulse and step functions, and the use of Laplace-Fourier transforms are related to the more classical mathematical concepts. Author (GRA)

N73-25226# Purdue Univ., Lafayette, Ind.
CONTINUOUS FILTER MATHEMATICAL CONCEPTS. VOLUME 2: DESIGN OF CONTINUOUS, LUMPED PARAMETER LINEAR FILTERS
Benjamin J. Leon Griffiss AFB, N. Y. RADC Dec. 1972 68 p refs 2 Vol.
(Contract F30602-72-C-0105)
(AD-757545; RADC-TR-72-311-Vol-2) Avail: NTIS CSCL 09/5

Most filters used in the separation of signals on the basis of frequency are derived by transformation of standard lowpass filter functions. These standard functions include the Butterworth, Chebyshev, Bessel Polynomial, and Elliptic Function filters. The first two and the last of these approximate the magnitude of an ideal lowpass filter. The Bessel Polynomial filter approximates the linear phase of an ideal lowpass filter. All of these prototype filters are discussed herein. To make a practical filter, one converts a lowpass prototype to a lowpass, highpass, bandpass, or bandreject filter. This final filter must have practical element values for fabrication with electronic circuit components. Problems of frequency transformation and frequency and magnitude scaling to give practical filters are discussed. Both the use of passive filters as interstage coupling networks and the design of active filters are presented. Author (GRA)

N73-25227# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE CALCULATION OF LOWER BOUNDS ON THE BREAKDOWN POWER LEVELS OF ELECTROMAGNETIC STRUCTURES Physical Sciences Research Papers
Dallas T. Hayes 7 Feb. 1973 40 p refs
(AF Proj. 4646)
(AD-759790; AFCRL-PSRP-534; AFCRL-TR-73-0095) Avail: NTIS CSCL 09/5

The prediction of the power level at which a plasma-covered antenna will break down is most difficult. Yet the problem is of crucial importance for all reentry vehicles and especially for ECM vehicles which must operate at high power levels for jamming purposes. Recently variational techniques have been applied to estimate breakdown power levels. These techniques have one drawback in that only upper bounds are provided, that is, the power level above which breakdown definitely takes place. Depending on the accuracy of a particular calculation, breakdown may occur for an appreciable power range below the estimated level. What is needed is a lower bound on the breakdown field strength. In the report a formulation of variational theory is given which allows lower bounds to be calculated. (Author Modified Abstract) GRA

N73-25228# Princeton Univ., N.J. Solid State and Materials Lab.
OXIDE CHARGE TRAPPING INDUCED BY ION IMPLANTATION DISPLACEMENT DAMAGE
E. Harari and B. S. H. Royce 16 Apr. 1973 11 p refs
(Contract N00014-67-Z-0151-0034)
(AD-758695; PSSL-160473) Avail: NTIS CSCL 09/1

Measurements have been made on the effects of ion implantation displacement damage and subsequent thermal annealing on charge transport and trapping within the SiO2 insulator of an MIS capacitor. Internal photoemission, current-voltage and capacitance-voltage measurements have been made in the temperature range between 80 and 300K. Prolonged thermal annealing was found to remove trap levels detectable with internal photoemission techniques but still left greater densities of electron traps in the oxide than those characteristic of unimplanted samples. These traps had an asymmetric spatial

distribution within the oxide and may partially compensate for hole trapping under ionizing radiation and consequently be responsible for the improved radiation hardness reported for implanted MIS devices. Author (GRA)

N73-25229# Princeton Univ., N.J. Solid State and Materials Lab.
THE EFFECTS OF ELECTRON AND HOLE TRAPPING ON THE RADIATION HARDNESS OF Al2O3 MIS (METAL INSULATOR SEMICONDUCTOR) DEVICES
E. Harari and B. S. H. Royce 17 Apr. 1973 12 p refs
(Contract N00014-67-Z-0151-0034)
(AD-758696; PSSL-170473) Avail: NTIS CSCL 09/1

The radiation sensitivity of MIS structures incorporating thin films of pyrolytically deposited Al2O3 has been investigated for X-irradiations at 300 and 80K. Under most conditions the increased radiation hardness of this oxide relative to SiO2 can be attributed to the role played by electron traps, however under some conditions hole trapping is found to dominate the radiation behavior. Energy levels associated with these electron and hole trap levels have been investigated using the photodepopulation technique. The temperature at which the oxide was deposited was found to be an important factor in determining the density of these traps. Author (GRA)

N73-25230# Aerospace Corp., San Bernardino, Calif. Reentry Systems Div.
PREDICTED RADAR CROSS SECTION OF THIN, LONG WIRES COMPARED WITH EXPERIMENTAL DATA Technical Report, Dec. 1971 - Sep. 1972
Jacques Renau and Michael T. Tavis 1 Oct. 1972 70 p refs
(Contract F04701-72-C-0073)
(AD-758757; TR-0073(3450-16)-2; SAMSO-TR-73-136) Avail: NTIS CSCL 09/5

In order to determine the validity and accuracy of Radar Cross Section (RCS) predictions for thin wires, the predictions of the closed-form expressions developed by Chu, Tai, Van Vleck, et al., and Ufimtsev have been compared with carefully measured backscattered RCS vs angle of incidence for various length thin, long, cylindrical conductors. Further, the prediction of an open-form numerical analysis based on the Source Distribution Technique and programmed by M. B. Associates as the BRACT computer program was also compared with the experimental data. (Author Modified Abstract) GRA

N73-25231# Texas Instruments, Inc., Dallas. Equipment Group.
PARALLEL CHANNEL FORWARD LOOKING INFRARED DISPLAY Final Technical Report, Jun. 1971 - Jul. 1972
Harry L. Higginbotham and Gary L. Johnson Griffiss AFB, N. Y. RADC Feb. 1973 48 p
(Contract F30602-71-C-0329)
(AD-759224; TI-U1-990-110-F; RADC-TR-73-46) Avail: NTIS CSCL 09/5

The report describes a program that demonstrates the feasibility of a high-resolution, pulsewidth-modulated, small-volume paralled-channel display technique suitable for remote use with high-resolution forward-looking infrared (FLIR) systems. The report includes a description of the development and evaluation of an engineering model display, and describes an electronic simulator used in evaluating the display. Results of the evaluation demonstrated that this advanced display technique provides improved resolution, modulation transfer capability, and opportunity for growth over current FLIR display techniques. Supporting design studies outlined approaches to applying this technique to existing FLIR systems. Author (GRA)

N73-25232# General Electric Co., Schenectady, N.Y. Research and Development Center.
MONOLITHIC LIGHT EMITTING DIODE DISPLAY Quarterly Technical Report, 1 Sep. - 30 Nov. 1972
Lawrence C. Kravitz Mar. 1973 23 p
(Contract DAAB07-72-C-0125; DA Proj. 1S6-62705-A-055)
(AD-758853; SRD-73-048; ECOM-0125-3; QTR-3) Avail: NTIS CSCL 09/5

Progress in the design and development of thick film multilayer ceramic substrates, and the design and layout of the prototype electronic system, using the same electronic elements as the final device, are described. Progress in the development of monolithic GaP wafers having epitaxial x-y matrix addressed light emitting diodes is also reviewed, and the program for the next quarter is outlined. Author (GRA)

N73-25233# Naval Avionics Facility, Indianapolis, Ind.
A COAXIAL CONNECTOR FOR THE STANDARD HARDWARE PROGRAM
John C. Willenbrock 1 Mar. 1973 70 p
(AD-758649; NAFI-TR-1761) Avail: NTIS CSCL 09/1

The report presents a design of a Standard Hardware Program (SHP) Coaxial Connector. Discussed are the need, limitations, design and test results of the connector, as well as criteria on which each is based. Author (GRA)

N73-25234# Radio Corp. of America, Princeton, N.J.
CHARGE-COUPLED IMAGER Final Report, 7 Jun. 1971 - 6 Jun. 1972
Paul K. Weimer, Michael G. Kovac, Winthrop S. Pike, and Frank V. Shallcross Sep. 1972 124 p refs
(Contract N00014-71-C-0415)
(AD-758741; PRRL-72-CR-41) Avail: NTIS CSCL 09/5

An investigation of the factors affecting the design of charge-coupled image sensors was undertaken. Single-line three-phase charge-coupled sensors having 100 to 500 elements have been produced on n or p-type substrates. A 45 x 60 element three-phase sensor array has been built and evaluated. Picture quality has been generally excellent although resolution was limited in some samples by transfer losses. Sensor designs which prevent spurious signals (or blooming) due to bright objects in the scene are discussed. Sensor output circuits which allow effective separation of the clock signals have been tested. Novel circuits have been proposed for improving the operating sensitivity of charge-transfer sensors at very low light levels. These include circuits permitting operation at reduced threshold scene brightness by controllable exchange of resolution for signal-to-noise ratio. Author (GRA)

N73-25235# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF PHASE LOCKING OF MICROWAVE OSCILLATORS M.S. Thesis
Jackie Lee Clark Dec. 1972 39 p refs
(AD-758677) Avail: NTIS CSCL 09/5

The paper is a report on experimental thesis work which investigated phase locking of a reflex klystron with a more stable micro-wave source. A discussion of the characteristics and components of a phase-locked loop and a qualitative overview of the theory of phase-locked loop operation is included. The specific circuit which accomplished phase locking at approximately 9.1 GHZ is described, with particular emphasis on the use of a crystal mixer to provide the feedback voltage for klystron frequency control. Capture and tracking ranges of this phase-locked loop are predicted and determined experimentally. The stabilization of the reflex klystron frequency by the phase-locked loop is demonstrated by spectrum photographs. A phase detector circuit which is expected to provide a wide capture and tracking range with the VCO offset from the reference frequency is proposed and described. Progress toward realization of this detector and suggestions for its improvement are included. Author (GRA)

N73-25236# General American Transportation Corp., Niles, Ill. General American Research Div.
EDDY CURRENT MEASUREMENT OF MAGNETIC FLUX DENSITY Technical Report, Jul. 1971 - Jan. 1972
I. R. Kraska and R. G. Prusinski Nov. 1972 36 p refs
(Contract F33615-71-C-1552; AF Proj. 7351)
(AD-759207; AFML-TR-72-115) Avail: NTIS CSCL 14/2

The report presents the results of an effort to improve the reliability of magnetic particle inspection of large or irregular-shaped parts by assuring optimum magnetic flux densities in the areas of interest during inspection. An assessment of flux density influence on the sensitivity of magnetic particle inspection is given. Data is provided showing eddy current response to changes in magnetic flux densities in the range of 2 to 13.5 kilogauss. This range is investigated to assure compatibility with the inspection density requirements of MIL-I-6868. This range can be changed by simple instrument adjustments. (Author Modified Abstract) GRA

N73-25237# Northrop Corp., Hawthorne, Calif.
EVALUATION OF SEMICONDUCTOR DEVICE ANALYSIS USING THE NET-2 COMPUTER PROGRAM Final Report, Feb. - Oct. 1972
J. R. Raymond and M. G. Krebs Oct. 1972 48 p
(Contract DAAG39-72-C-0065)
(AD-758883; NRTC-72-6R; HDL-065-1) Avail: NTIS CSCL 09/1

An evaluation of the capability of the NET-2 Circuit/System Analysis Computer Program to perform analysis of radiation effects on complex semiconductor devices and microcircuits is presented. The mathematical models considered include both the terminal built-in models and Linvill lumped models of bipolar and MOS devices. Computations of electrical performance and transient radiation-induced response are performed and compared to available exact results. The derivation of complex models for the elements of a junction-isolated bipolar microcircuit (including the multiple emitter transistor) is demonstrated as well as the analysis of a complete junction-isolated TTL Gate microcircuit. NET-2 capabilities in terms of computer run times, numbers of circuit elements allowed, and accuracy of solution are discussed. Device analysis examples include a p-n junction diode and an intrinsic lumped model p-n-p transistor. Author (GRA)

N73-25238# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
AN AVIONICS DIGITAL FREQUENCY SYNTHESIZER
Harlan H. Knapp Nov. 1972 56 p refs
(Contract N00017-72-C-4401)
(AD-759699; APL-TG-1203) Avail: NTIS CSCL 09/5

The avionics frequency synthesizer generates frequencies in four bands for use with aircraft communications and navigational equipment. Four phase-locked loops having a common reference oscillator and using digital techniques have been used to give a reliable, accurate, and low-cost design. Author (GRA)

N73-25239# New Mexico Inst. of Mining and Technology, Socorro. Dept. of Metallurgical and Materials Engineering.
SHOCK-ASSOCIATED ELECTRICAL RESPONSES IN PLATE CAPACITORS
Ching H. Ma 12 Apr. 1973 13 p refs
(Contract N00014-67-A-0267-0003; NR Proj. 031-728)
(AD-759059; NMT-5; TR-5) Avail: NTIS CSCL 09/1

A theory is presented to show that when a plane shock wave passes through a plate capacitor, the effect of shock on the Fermi energy level of one of the metallic electrodes can trigger an electrical response of the capacitor. The response may be large if a combination of factors is favorable. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-25240* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPARATUS FOR STATISTICAL TIME-SERIES ANALYSIS OF ELECTRICAL SIGNALS Patent
Carrington H. Stewart, inventor (to NASA) Issued 8 May 1973 12 p Filed 11 Aug. 1971 Supersedes N72-11259 (10 - 02, p 0182)
(NASA-Case-MSC-12428-1; US-Patent-3,732,405; US-Patent-Appl-SN-170681; US-Patent-Class-235-151.31; US-Patent-Class-179-1SA; US-Patent-Class-324-77R; US-Patent-Class-324-78J) Avail: US Patent Office CSCL 09C

An apparatus for performing statistical time-series analysis of complex electrical signal waveforms, permitting prompt and accurate determination of statistical characteristics of the signal is presented. Offical Gazette of the U.S. Patent Office

N73-25241* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNAL-TO-NOISE RATIO DETERMINATION CIRCUIT Patent
Leonard F. Deerkoski, inventor (to NASA) Issued 5 Jun. 1973 7 p Filed 15 Sep. 1971 Supersedes N72-20233 (10 - 11, p 1449)
(NASA-Case-GSC-11239-1; US-Patent-3,737,781; US-Patent-Appl-SN-180683; US-Patent-Class-325-363; US-Patent-Class-325-67) Avail: US Patent Office CSCL 09C

A signal-to-noise ratio (SNR) determination of an input is described, having signal components within a given frequency range and noise components, without actual measurement of the noise components. Bandpass limiter having a constant signal plus noise output level is connected to the output of the first filter, the signal-to-noise ratio of the input to the bandpass limiter being linearly related to the dbm level of signal components at the output. Calibration is connected to the bandpass limiter and is responsive to the signal components at the output to derive the SNR of the input to the determination circuit. The SNR determination circuit is disclosed for use in a diversity receiver having a plurality of input channels.
Official Gazette of the U.S. Patent Office

N73-25242 Connecticut Univ., Storrs.
A STUDY OF PULSE WIDTH MODULATION IN FEEDBACK CONTROL SYSTEMS Ph.D. Thesis
Walter Richard Kolk 1972 177 p
Avail: Univ. Microfilms Order No. 72-32149

A describing function for a trailing edge pulse width modulator is developed by determining the first harmonic output of the modulator due to a sinusoidal input. The condition of saturation in the modulator is also considered and it is shown that at large values of the modulation index, the describing function of the pulse width modulator approaches that of an ideal relay. Trailing edge modulation is shown to introduce a phase lag which is destabilizing in a feedback system, but the saturation prevents complete instability. Experimental results were obtained in two different digital simulations and also an analog computer simulation. Limit cycles were observed which verify the validity of the describing function and also indicate that harmonic distortion in the input signal to the pulse width modulator due to sideband propagation around the loop influences the pulse phasing. All experimental results show that the limit cycle is an integral multiple of the modulation index. Dissert. Abstr.

N73-25243* North American Rockwell Corp., Canoga Park, Calif.
CIRCUIT BOARD PACKAGE WITH WEDGE SHAPED COVERS Patent
Clarence T. Pesek, inventor (to NASA) Issued 22 May 1973 6 p Filed 28 Oct. 1971 Sponsored by NASA
(NASA-Case-MFS-21919-1; US-Patent-3,735,206; US-Patent-Appl-SN-193456; US-Patent-Class-317-100; US-Patent-Class-317-101DH) Avail: US Patent Office CSCL 09C

A circuit board packaging and mounting technique that protects the wiring board from vibrations and contamination is described. The technique also auguments chassis rigidity and damping and conducts component generated heat to the chassis. Official Gazette of the U.S. Patent Office

N73-25244# Lockheed Missiles and Space Co., Palo Alto, Calif.
APPARATUS TO EXTRACT THE BEGINNING AND ENDING OF A PULSE TRAIN
V. M. Kirpichnikov, I. N. Petrikevich, A. A. Ananev, and V. O. Lotkin [1973] 3 p refs Transl. into ENGLISH from Pribory i Sistemy Upravleniia (Moscow), no. 3, 1973 p 30
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

In an investigation of the design of automated checking and control systems which monitor technological processes, particular attention is drawn to the necessity of extracting the beginning and ending of pulse trains. A technique for this extraction is described whereby the most important characteristics of the process relate to the determination of the actuation time by the duration of the time interval between the time the leading edge of the first pulse of the train is presented to the unit input, and the time the trigger is switched into the unstable state. J.M.M.

N73-25245# Lockheed Missiles and Space Co., Palo Alto, Calif.
CONTACTLESS EXTREMUM UNIT
S. Ia. Krasiukova and A. A. Ter-Khachaturov [1973] 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 16, no. 3, 1973 p 41-45
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A description is given of an extremum unit capable of being in three diverse stable states, cutoff, saturation, and generation, because of positive transformer feedback and a differentiating loop at the input. Distinct alternation of these signals permits a judgement on the nature of the extremum values of an input time function. Author

N73-25246*# GTE Labs., Inc., Waltham, Mass.
DESIGN, FABRICATION, TESTING, AND DELIVERY OF IMPROVED BEAM STEERING DEVICES Final Report
Apr. 1973 348 p refs
(Contract NAS8-26846)
(NASA-CR-124283; GT/E-TR-73-842.3) Avail: NTIS HC $19.50 CSCL 09C

The development, manufacture, and testing of an optical steerer intended for use in spaceborne optical radar systems are described. Included are design principles and design modifications made to harden the device against launch and space environments, the quality program and procedures developed to insure consistent product quality throughout the manufacturing phase, and engineering qualification model testing and evaluation. The delivered hardware design is considered conditionally qualified pending action on further recommended design modifications. Author

N73-25247# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
ELECTRONIC PRODUCTS TECHNICAL NOTES, VOLUME 1, FISCAL YEARS 1971 AND 1972 Final Report
Dec. 1972 32 p refs
(PB-213755/2; BRH/DEP-N71-1-Vol-1; BRH/DEP-N72-6-Vol-1) Avail: NTIS HC $3.00 CSCL 06R

Technical notes included are: evaluation of a rayguard high-voltage warning device for color TV monitoring, circuitry for a 3-second response time in the Narda 8110 microwave survey instrument, a program for calculating near-zone gain of pyramidal horn antennae, static testing of high voltage rectifier tubes for X-ray emission, problems of power measurement using non-square-law detectors, direct-print paper: a new material for X-ray imaging, test method for fluoroscopic beam alignment, modification of electronic X-ray pulse counter, and switch failure monitoring device. Author (GRA)

N73-25248# IIT Research Inst., Chicago, Ill. Reliability Analysis Center.
MICROCIRCUIT GENERIC ENVIRONMENTAL DATA
Irvin L. Krulac Oct. 1972 147 p
(Contract F30602-72-C-0183)
(AD-753256; RAC-MGED-1072) Avail: NTIS HC $30.00/MF $30.00 CSCL 09/5

Environmental test and screen/burning results on microelectronic devices are reported. Data is organized according to applied test stress and device generic properties. Aside from a description of the device and stress conditions, each data entry reports the number of devices tested, number failed and observed failure modes. A total of 2360 data entries are contained in this issue of which 2218 are environmental test results and the remaining are 142 screen/burning results. Author (GRA)

N73-25249# Rockwell International Corp., Anaheim, Calif. Electronics Group.
SURVIVABLE P-CHANNEL METAL-OXIDE-SEMICONDUCTOR (PMOS) COMPUTER DESIGN Final Report, 20 Mar. - 20 Sep. 1972
Daryl T. Butcher, Howard Maddox, and Robert L. Nielsen Mar. 1973 135 p refs
(Contract F33615-72-C-1732; AF Proj. 3176)
(AD-759189; C72-446/501; AFAL-TR-73-31) Avail: NTIS CSCL 09/2

The significance of this project to the Air Force is the fact that it provides assessment, and develops specifications for employment, of advanced radiation-hardened field-effect Metal-Oxide-Semiconductor (MOS) and Metal-Nitride-Oxide-Semiconductor (MNOS) technologies for military/space computer systems. The characteristics and capabilities of the device and packaging technologies, required for MOS/MNOS computer construction, are defined and compared to the techniques and hardware requirements for long-life computer systems. A computer architecture is derived from the comparison analysis. (Author Modified Abstract) GRA

N73-25250# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INDUCTANCE OF A CRYOGENIC SYNCHRONOUS MACHINE WITH A DAMPING SYSTEM
A. I. Bertinov, O. M. Mironov, and V. S. Mokin 3 Apr. 1973 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Trans. (Moscow), no. 4, 1972 p 56-60
(AD-759235; FTD-MT-24-67-73) Avail: NTIS CSCL 09/3

The natural inductance of the damping system of a cryogenic synchronous machine without a ferromagnetic circuit is calculated. The mutual inductances are determined for a damper with windings and graphs are given for the dependences of mutual inductances on the relative geometric dimensions of the machine. (Author Modified Abstract) GRA

N73-25251# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary Report, 1 Nov. 1972 - 31 Jan. 1973
Melvin A. Herlin, Herbert G. Weiss, and Alan L. McWhorter 15 Feb. 1973 23 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-759180; ESD-TR-73-60) Avail: NTIS CSCL 20/12

The Quarterly Technical Summary covers the period 1 November 1972 through 31 January 1973. It consolidates the reports of Division 2 (Data Systems), Division 4 (Air Traffic Control), and Division 8 (Solid State) on the Advanced Electronic Technology Program. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-25252 Rensselaer Polytechnic Inst., Troy, N.Y.
THE CONCEPTUAL DESIGN OF AN UNMANNED ROVING VEHICLE FOR SURFACE EXPLORATION OF MARS Ph.D. Thesis
Wilson Parker Rayfield 1972 162 p
Avail: Univ. Microfilms Order No. 72-30230

An unmanned mobile vehicle to transport an instrument package over the surface of Mars is described. A roving vehicle concept was designed expressly for such a mission. Due to great distance from Earth to Mars, there exists a communications time delay, making remote control from Earth impractical; therefore, the vehicle must rely upon onboard, programmed computers for guidance. Thus the vehicle must be highly maneuverable and versatile. The four-wheel Mars Roving Vehicle (MRV) proposed is based on the concept of an adjustable, aft-located center of gravity. Fore-and-aft tilting of the single-module payload enables the MRV to control its stability on slopes, and shift between two modes of operation. The four-wheel mode features a light-weight wagon-steering system, which, in conjunction with individually driven rear wheels, provides excellent maneuverability. Dissert. Abstr.

N73-25253# Polytechnic of Central London (England). Transport Studies Group.
THE ECONOMICS OF BRITISH AIRPORTS
R. S. Doganis and G. F. Thompson May 1973 242 p refs Sponsored by Social Sci. Res. Council

(Rept-73-01210) Avail: NTIS HC $14.25
An analysis is presented on the economics and finances of airports, as industrial units, to develop a theory of airport economics, with special reference to airport pricing. Recommendations were made on the following major issues: (1) the financial structure of airports, (2) measures of airport profitability and efficiency, (3) the scope and effect of management decisions on airport finances, and (4) possible improvements in current pricing and charging policies. Data are presented in the form of tables and graphs to show airport practices and operations from a financial standpoint. Author

N73-25254# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DUAL LANE RUNWAY STUDY Final Report, 15 Oct. 1971 - 15 Dec. 1972
V. S. Dolat and J. C. Koegler 22 May 1973 244 p refs
(Contracts F19628-73-C-0002; DOT-FA72WAI-248; FAA Proj. 082-421-214)
(ATC-17; FAA-RD-73-60) Avail: NTIS HC $14.25
A series of dual lane runway computer simulation experiments were performed to investigate the pertinent dual lane issues: (1) centerline spacing, (2) arrival/departure preference, (3) parallel taxiway, (4) threshold stagger, and (5) high speed exits. In addition, time was spent analyzing operational high density airport terminal facilities. Airport administrative and operations personnel were interviewed to obtain their views on high density operations and the dual lane concept. Peak rush hour periods were sought out to determine control strategies employed in directing peak period traffic. Air crews utilizing these high density airport terminals were interviewed in the course of their operations into and out of these major hub airports. Author

N73-25255# Rochester Univ., N.Y. Nuclear Structure Research Lab.
MP TANDEM UPGRADING PROGRAM
Kenneth H. Purser May 1973 36 p refs Presented at the Conf. on Electrostatic Accelerators, Daresbury, England, 4 May 1973
(UR-NSRL-71) Avail: NTIS HC $4.00
The design related obstacles involved in the production of an electrostatic accelerator able to sustain terminal voltages significantly greater than 10 MV are considered. Then, techniques are presented diagrammatically to illustrate a workable design of an accelerator whose potential capacity exceeds 13 MV.
J.M.M.

N73-25256# Naval Submarine Medical Research Lab., Groton, Conn.
HIGH PRESSURE REACTION VESSEL SYSTEM 1. INSTALLATION, MODIFICATION AND INITIAL EXPERIMENTS Interim Report
Alexander H. Smith and Donald V. Tappan 9 Jun. 1972 14 p refs
(AD-752978; NAVSUBMEDRSCHLAB-713; Rept-73-01204) Avail: NTIS HC $3.00 CSCL 06C
A high pressure system with several small sample vessels was successfully modified for conducting a variety of biological reactions. Various problems encountered in making modifications to the system and their solutions are described. The most successful experiments to date have utilized erythrocytes and liver preparations for the study of glycolysis under various atmospheres and pressures. The principal advantages of the system is its versatility in reaction conditions and methods of sampling. Author

N73-25257# Construction Engineering Research Lab., Champaign, Ill.
DEVELOPMENT OF A STANDARD DATA BASE AND COMPUTER SIMULATION MODEL FOR AN AIR CARGO TERMINAL
Lawrence P. McNamee and Chao Lee Jan. 1973 51 p refs
(AD-753925; TR-A-8; Rept-73-01198) Avail: NTIS HC $4.75 CSCL 01E
A GERTS 3Q simulation model for a Dortech air cargo facility is described and a recommendation for the development of a compatible Army-Air Force air cargo data base system is given. Author

N73-25258*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESIGN AND PERFORMANCE OF THE AMES ELECTRIC-ARC SHOCK TUNNEL
John O. Reller, Jr. Washington Jun. 1973 71 p refs
(NASA-TM-X-2814; A-4606) Avail: NTIS HC $3.00 CSCL 14B
A high enthalpy shock tunnel using arc-heated helium as the driver gas was designed for gas dynamic research at total stream energies from 7,000 to 35,000 j/g. The arc driver was found to be a relatively efficient energy converter. Tailored shock Mach numbers from 11.5 to 14.6 in air were demonstrated. A nozzle calibration with a total stream enthalpy of 18,600 j/g of air gave test times of 1.5 to 2.0 m sec at flow Mach numbers from 16 to 24. Author

N73-25259*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION AND PERFORMANCE OF THE LANGLEY DIFFERENTIAL MANEUVERING SIMULATOR
B. R. Ashworth and William M. Kahlbaum, Jr. Washington Jun. 1973 96 p refs
(NASA-TN-D-7304; L-8827) Avail: NTIS HC $3.00 CSCL 14B
The differential maneuvering simulator for simulating two aircraft or spacecraft operating in a differential mode is described. Tests made to verify that the system could provide the required simulated aircraft motions are given. The mathematical model which converts computed aircraft motions into the required motions of the various projector gimbals is described. Author

N73-25260*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SPARES AND REPAIR PARTS SUPPORT PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169
W. W. Vinson Oct. 1971 22 p refs Revised
(Contract NAS9-11528)
(NASA-CR-128571; T72-19226-Rev-D) Avail: NTIS HC $3.25 CSCL 14B
The spares and repair parts program for the ultraviolet spectrometer experiment is outlined. The plan includes information on the selection, purchase, acceptance, and storage of spare parts, and on repair procedures. Author

N73-25041 Ministry of Supply, London (England).
CALCULATION OF FLEXIBLE WALL SHAPES AND PREPARATION OF CONTROL TAPES FOR THE BEDFORD 8-FT BY 8-FT WIND TUNNEL
Marjorie M. Barritt and K. V. Diprose *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1325-1357 refs (For availability see N73-25020 16-01)
(ARC-R/M-3187; RAE-R-MS-54)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-25261 National Lending Library for Science and Technology, Boston Spa (England).
THE EQUILIBRIUM CONDITIONS FOR A MULTI-COMPONENT LIQUID AT THE SURFACE OF A SOLID BODY
G. A. Grigorev [1973] 10 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya MEt. (Moscow), v. 9, 1972 p 120-122 In RUSSIAN and ENGLISH
(NLL-M-21577-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon
The condition for the equilibrium of a multi-component liquid at the surface of a solid body is considered. Allowance is made for the selective adsorption of its components at the interphase boundaries. Mathematical models are included to clarify the

theoretical concepts. A diagram for determining the conditions for equilibrium of a multi-component liquid is included. Author

N73-25262* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS AND METHOD FOR GENERATING LARGE MASS FLOW OF HIGH TEMPERATURE AIR AT HYPERSONIC SPEEDS Patent
William B. Boatright, inventor (to NASA) Issued 8 May 1973 6 p Filed 9 Mar. 1972 Supersedes N72-22338 (10 - 13, p 1734)
(NASA-Case-LAR-10578-1; US-Patent-3,731,528; US-Patent-Appl-SN-233098; US-Patent-Class-73-147) Avail: US Patent Office CSCL 20D

A description is given of tests performed in the Mach number 8 to 10 regime to generate high temperature air at hypersonic speeds. The test flow was obtained by pressuring a ceramic lined storage tank with air to a pressure of about 100 to 200 atm. The air is heated to temperatures of 7,000 R to 8,000 R prior to introduction into the tank by passing air through an electric arc heater. The air cools to 5,500 R to 6,000 R while in the tank and then it is rapidly released through a Mach number 8 to 10 nozzle. Cold air or hot driver gas under pressure is injected simultaneously with the release of pressurized hot air and regulated to enter the tank at the same rate the hot air is leaving. This holds pressure in the tank constant during the test. Alternatively, the driver gas is introduced into the tank prior to the discharge of the hot air to increase the pressure in the tank and permit tests at higher pressures than can be handled by the arc heater. Official Gazette of the U.S. Patent Office

N73-25263 Michigan Univ., Ann Arbor.
ONSET OF CONVECTIVE INSTABILITY OF BINARY GAS MIXTURES IN POROUS MEDIA Ph.D. Thesis
Michael Layiwola Lawson 1972 82 p
Avail: Univ. Microfilms Order No. 72-29128

The stability of a horizontal layer of binary gas mixture in porous medium with the upper and lower boundaries at different temperatures is analyzed. With the inclusion of thermal diffusion effect, it is shown that when the lower boundary has the higher temperature, the mixture becomes unstable when the Rayleigh number exceeds a critical value. This critical value depends on the composition as well as the molecular weights of the constituent components. An infinitesimal perturbation technique is employed in the analysis. A modified form of Darcy's law is used for the equations of momentum which with energy and mass transfer equations results in eigenvalue differential equations.
Dissert. Abstr.

N73-25264 Maryland Univ., College Park.
AN EXPERIMENTAL INVESTIGATION OF WATER ENTRY Ph.D. Thesis
John Lucas Baldwin, Jr. 1972 235 p
Avail: Univ. Microfilms Order No. 72-28902

The behavior of a projectile as it passes from air into water was investigated. The behavior of the water during the establishment of the flow and the development of the cavity is a transient phenomenon. A description of the behavior of the fluid during the entry of a body requires a knowledge of pressures, sizes and shapes as functions of time. An extensive experimental program has been conducted in order to determine these functions. The surface pressures, axial body accelerations and fluid surface motions have been studied during the vertical entry of light conical bodies of 45-,90- and 140-degree total angle. Also, the axial accelerations and surface motions have been studied during the oblique entry of a moderately heavy disk cylinder. All of these tests include the flow-establishment phase and the early cavity-development phase. Dissert Abstr.

N73-25265 Maryland Univ., College Park.
A STUDY OF THE MOTION OF LAMINAR AND TURBULENT VISCOUS VORTEX RINGS Ph.D. Thesis
Raymond Stanley Widmayer 1972 189 p
Avail: Univ. Microfilms Order No. 72-28881

A study of the motion of laminar and turbulent viscous vortex rings was carried out. A variety of laminar and turbulent vortex rings was produced in air by a pneumatic-actuated, piston vortex generator. The vortex rings were measured with hot-wire anemometer equipment. These measurements yielded translational velocity, ring diameter, core diameter, and circulation at several locations downstream from the generator orifice. Stroboscopic photography was employed to describe the initial vortex-ring-development process. An analysis of the laminar data indicates that Hamel-Oseen line-vortex theory, when used to approximate the laminar-vortex-ring flow, predicts the measured laminar core growth. The introduction of measured laminar-vortex-ring parameters into an expression derived from inviscid flow theory predicts laminar-vortex-ring translational velocities which agree with the observed velocities. Dissert. Abstr.

N73-25266 Stanford Univ., Calif.
LAMINAR FLOW FORCED CONVECTION HEAT TRANSFER AND FLOW FRICTION IN STRAIGHT AND CURVED DUCTS: A SUMMARY OF ANALYTICAL SOLUTIONS Ph.D. Thesis
Ramesh Keshavlal Shah 1972 390 p
Avail: Univ. Microfilms Order No. 72-30698

Theoretical laminar flow solutions for heat transfer and flow friction in the development of new types of compact heat exchangers are discussed. Generally the higher the degree of compactness, the lower is the Reynolds number and the greater is the relevance of the theory solutions. Solutions are compiled, using a common format, for twenty-one straight ducts and four curved ducts. The steady state, constant properties, Newtonian fluid flowing through a stationary, two-dimensional duct is considered. The effects of free convection, mass transfer and change of phase are omitted. Some new analytical solutions are obtained by writing a new computer oriented method for the following ducts: rectangular, isosceles triangular, rounded corner equilateral triangular and sine ducts. Application of the analytical solutions to the gas turbine regenerator is discussed.
Dissert. Abstr.

N73-25267 Stanford Univ., Calif.
THE STEADY-STATE RESPONSE OF AN INTERFACE TO A MOVING DISTURBANCE Ph.D. Thesis
Timothy Christopher Kennedy 1972 132 p
Avail: Univ. Microfilms Order No. 72-30647

Three separate but related problems are treated which involve the steady-state response of some type of interface to a disturbance moving with constant velocity. First, the problem of a moving point load on a fluid-solid interface is studied. The steady-state response of a semi-infinite solid with an overlying acoustic fluid, subjected at the plane interface to a moving point load is determined through integral transform techniques. For supersonic load velocities, the exact closed form solution valid for the entire space is presented. For load speeds less than supersonic, the displacements in the solid and velocity potential of the fluid are obtained in terms of algebraic expressions and single finite integrals which can be readily evaluated numerically. Numerical results for the displacements at the interface are also presented for load speeds in each range. Dissert. Abstr.

N73-25268 Stanford Univ., Calif.
PERTURBATION SOLUTION FOR VISCOUS INCOMPRESSIBLE FLOW IN CHANNELS Ph.D. Thesis
Ralph David Lucas 1972 111 p
Avail: Univ. Microfilms Order No. 72-30664

Analytic solutions for separated laminar flows in a variety of divergent channels are obtained using a perturbation method. While the method is applicable to a general asymmetric channel, or to an axisymmetric tube, for simplicity only the case of a plane symmetric channel y = + or - f (epsilon x) is considered, where f is some analytic function. The Navier-Stokes equations for a viscous incompressible fluid are solved by an expansion in powers of epsilon, the parameter characterizing the slope of the channel wall. The first approximation is just the familiar Poiseuille solution. The differential equations for the higher approximations are reduced to an algebraic recursion problem suitable for computer solution. The convergence of the high-order power series that are obtained are assessed using a graphical technique of Domb and Sykes. Dissert. Abstr.

N73-25269 Purdue Univ., Lafayette, Ind.
DESIGN OF MAXIMUM THRUST NOZZLES WITH NONEQUILIBRIUM, CHEMICALLY REACTING FLOW Ph.D. Thesis

Allan Arthur Taylor 1972 102 p
Avail: Univ. Microfilms Order No. 72-30987

An analysis is presented which permits the design of maximum thrust nozzles for nonequilibrium, chemically reacting gas flows. The analysis is based upon the governing equations for a general, multi-component reacting gas. The effects of viscosity, multiple phases, body forces, and mixing are neglected. All other states of the gas are assumed to be in equilibrium. Design of the nozzle contour is posed subject to a general isoperimetric constraint. The thrust to be maximized is written in terms of an integral of the pressure forces on the nozzle wall. The design constraints and governing equations are incorporated into the integral to be maximized by means of Lagrange multipliers. The method of the calculus of variations is applied to the integral to be maximized, resulting in a set of Euler equations, which are replaced by a set of characteristic and compatibility equations.
Dissert. Abstr.

N73-25270 Purdue Univ., Lafayette, Ind.
CONTRIBUTION TO A PHENOMENOLOGICAL TURBULENCE THEORY Ph.D. Thesis
Paul Isamu Nakayama 1972 115 p
Avail: Univ. Microfilms Order No. 72-30943

The phenomenological turbulence transport equation for the full Reynolds stress tensor of Harlow and Hirt is extended by a more extensive modeling of the pressure-velocity and pressure-velocity derivative correlations that appear as higher unknowns in the equation. The model terms that approximate these correlations preserve the tensor and Galilean invariance of the correlations and are also independent of the boundary and initial conditions. For a check of the model terms, the differenced form of these equations along with the mean momentum equations were integrated numerically for the two-dimensional turbulent jet flow. The predicted mean flow and turbulence energy components show agreement with measured values.
Dissert. Abstr.

N73-25271 Colorado State Univ., Fort Collins.
MASS DIFFUSION OVER WIND WAVES Ph.D. Thesis
Hsien Ta Liu 1972 162 p
Avail: Univ. Microfilms Order No. 72-31331

The mass diffusion process from an elevated point source over a wind-disturbed water surface was investigated experimentally and numerically. The diffusion model which generated from this study was used also to compare experimental with calculated concentration distributions for diffusion in the boundary layer of a flat plate and over a mechanically-generated water wave. An optical device was developed to measure mean and fluctuating concentrations of small aerosol particles in the wind field. The frequency response and sampling volume of the optical device were found to be adequate for this study and comparable approximately to those for a hot-wire anemometer. A steady stream of aerosol particles was generated by atomization of a heavy oil.
Dissert. Abstr.

N73-25272 Connecticut Univ., Storrs.
AN EXPERIMENTAL STUDY OF WIND GENERATED WAVES WITH AND WITHOUT PRESSURE GRADIENTS Ph.D. Thesis
Hui Chuan Liang 1972 134 p
Avail: Univ. Microfilms Order No. 72-32228

An experimental study of wind-generated waves was carried out in a wind-wave channel under the laboratory conditions with and without pressure gradients. A series of experiments was first conducted for the measurement of the boundary layer and turbulence over a smooth solid surface as a survey of the flow characteristics of the channel as well as a basis of reference for the wind waves. A steady, two-dimensional wind with three speeds of 6, 8, 12 meters per second over a water depth of 19 cm was established. The low turbulent wind was supplied by a blower blowing air through the damping screens and contraction unit at the upwind end and entered the test section with a smooth transition to the leading edge of the fetch. The progressive waves generated by the wind were absorbed at the downwind end by a sloping beach covered with damping screens.
Dissert. Abstr.

N73-25273 Colorado State Univ., Fort Collins.
TURBULENT FLOW OVER A WAVY BOUNDARY Ph.D. Thesis
Paul Stevens Beebe 1972 138 p
Avail: Univ. Microfilms Order No. 72-31311

An experimental study was made of turbulent flow over a wavy surface. Sinusoidal waves of three sizes were used to explore the variations of flow with wave size. Measurements of mean and turbulent velocities were taken with a two-wire method. Local heat transfer rates and pressures on the wavy surface were also measured. An equilibrium turbulent boundary layer, which conforms to Rotta's and Clauser's self-preservation requirements, develops in the region far downstream from the first wave. In the lower portion of this layer, the mean velocity is represented by the logarithmic velocity profile when the form-drag measurements of skin friction are used to determine the shift-in-origin. The roughness function is related to the wave height since the wavy surface is shown to be a k type surface. The velocity defect profile in the logarithmic form extends to higher values of than those for smooth wall flows.
Dissert. Abstr.

N73-25274 Connecticut Univ., Storrs.
A NUMERICAL STUDY OF VIBRATIONALLY EXCITED FLOWS PAST POINTED AND BLUNT BODIES Ph.D. Thesis
Jacob Polatnick 1972 197 p
Avail: Univ. Microfilms Order No. 72-32161

Dorodnitsyn's integral technique has been utilized to study real gas effects in supersonic flows over sharp and spherically blunted cones. The one and two-strip integral approximations were used to obtain solutions for the vibrational non-equilibrium shock shape and surface flow variables for the flow over a cone. Primary emphasis was placed on the comparison of the numerical accuracy of the solutions obtained for nonequilibrium flow, based on the one and two-strip approximations, for the case of low freestream Mach number and a vibrationally excited freestream. Frozen and equilibrium real gas conical flows are treated in detail. It is shown that the two-strip approximation is required to obtain accurate solutions for the non-equilibrium shock shape and surface flow variables as well as frozen and equilibrium shock detachment angles. Solutions for the equilibrium and non-equilibrium shock shape for vibrationally excited flows showed that the difference between the non-equilibrium and equilibrium shock layer height was greatest for thin cones at low freestream Mach number.
Dissert. Abstr.

N73-25275 Northwestern Univ., Evanston, Ill.
MICROWAVE REFLECTION STUDIES OF SHOCK WAVE INTERACTIONS AND END WALL REFLECTIONS Ph.D. Thesis
Holmes Andrew Webb 1972 155 p
Avail: Univ. Microfilms Order No. 72-32606

In order to determine the electron number density and collision frequency levels attained behind reflected shock waves in argon, the reflection coefficient of microwaves impinging on the interface between a dielectric and the plasma formed behind such shock waves was measured. The shock reflections were produced in two manners. Collisions of equal strength shock waves were generated in a double-ended electromagnetically driven shock tube. Later, removal of half the tube and replacement by an end wall facilitated comparison of these results with wall reflection measurements. The plasma-dielectric interfaces were created by inserting a truncated waveguide in the regions where shock wave reflection would occur. E-band equipment was employed to measure properties after the 500 micron Hg. initial pressure shock wave interactions.
Dissert. Abstr.

N73-25276*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
LOCAL SKIN FRICTION COEFFICIENTS AND BOUNDARY LAYER PROFILES OBTAINED IN FLIGHT FROM THE XB-70-1 AIRPLANE AT MACH NUMBERS UP TO 2.5
David F. Fisher and Edwin J. Saltzman Washington Jun. 1973 70 p refs
(NASA-TN-D-7220; H-710) Avail: NTIS HC $3.00 CSCL 20D

Boundary-layer and local friction data for Mach numbers up

to 2.5 and Reynolds numbers up to 3.6 x 10 to the 8th power were obtained in flight at three locations on the XB-70-1 airplane: the lower forward fuselage centerline (nose), the upper rear fuselage centerline, and the upper surface of the right wing. Local skin friction coefficients were derived at each location by using (1) a skin friction force balance, (2) a Preston probe, and (3) an adaptation of Clauser's method which derives skin friction from the rake velocity profile. These three techniques provided consistent results that agreed well with the von Karman-Schoenherr relationship for flow conditions that are quasi-two-dimensional. At the lower angles of attack, the nose-boom and flow-direction vanes are believed to have caused the momentum thickness at the nose to be larger than at the higher angles of attack. The boundary-layer data and local skin friction coefficients are tabulated. The wind-tunnel-model surface-pressure distribution ahead of the three locations and the flight surface-pressure distribution ahead of the wing location are included. Author

N73-25277*# City Univ. of New York.
CHARACTERISTICS OF DILUTE GAS-SOLIDS SUSPENSIONS IN DRAG REDUCING FLOW
Ronald S. Kane and Robert Pfeffer Washington NASA Jun. 1973 92 p refs
(Grant NGL-33-013-029)
(NASA-CR-2267) Avail: NTIS HC $3.00 CSCL 20D

Measurements were performed on dilute flowing gas-solids suspensions and included data, with particles present, on gas friction factors, velocity profiles, turbulence intensity profiles, turbulent spectra, and particle velocity profiles. Glass beads of 10 to 60 micron diameter were suspended in air at Reynolds numbers of 10,000 to 25,000 and solids loading ratios from 0 to 4. Drag reduction was achieved for all particle sizes in vertical flow and for the smaller particle sizes in horizontal flow. The profile measurements in the vertical tube indicated that the presence of particles thickened the viscous sublayer. A quantitative theory based on particle-eddy interaction and viscous sublayer thickening has been proposed. Author

N73-25278*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIFE TESTS OF SMALL TURBINE-TYPE FLOWMETERS IN LIQUID HYDROGEN
Howard F. Hobart, Herbert L. Minkin, and Isidore Warshawsky Washington Jun. 1973 17 p refs
(NASA-TN-D-7323; E-7371) Avail: NTIS HC $3.00 CSCL 14B

A total of 14 turbine-type flowmeters of 2.5- and 4-cm nominal size were operated for 100 or more hours at an average fluid speed in the unobstructed, upstream pipe of 20 m/s for the smaller meters and 9 m/s for the larger meters. Calibration shifts over a 6.1 range of calibration flow rates varied from 0.5 percent to 1 percent after 50 hr of operation. It is concluded that use of ball bearings with glass-filled Teflon retainers is most likely to produce minimal calibration shift with protracted use. Bearing replacement after 50 to 100 hr is recommended, depending on accuracy requirements, for meters used at the fluid speeds of the tests. Author

N73-25279*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A METHOD FOR CALCULATING TRANSIENT THRUST AND FLOW-RATE LEVELS FOR MARINER TYPE ATTITUDE CONTROL NITROGEN GAS JETS
John D. Ferrera 1 Jan. 1972 64 p refs
(Contract NAS7-100)
(NASA-CR-132987; JPL-TM-33-604) Avail: NTIS HC $5.25 CSCL 20D

The purpose of this report is to define and program the transient pneumatic flow equations necessary to determine, for a given set of conditions (geometry, pressures, temperatures, valve on time, etc.), the total nitrogen impulse and mass flow per pulse for the single pulsing of a Mariner type reaction control assembly valve. The rates of opening and closing of the valves are modeled, and electrical pulse durations from 20 to 100 ms are investigated. In developing the transient flow analysis, maximum use was made of the steady-state analysis. The impulse results are also compared to an equivalent square-wave impulse for both the Mariner Mars 1971 (MM'71) and Mariner Mars 1964 (MM'64) systems. It is demonstrated that, whereas in the MM'64 system, the actual impulse was as much as 56 percent higher than an assumed impulse (which is the product of the steady-state thrust and value on time i.e., the square wave), in the MM'71 system, these two values were in error in the same direction by only approximately 4 percent because of the larger nozzle areas and shorter valve stroke used. Author

N73-25280# California Univ., Santa Barbara. Dept. of Mechanical Engineering.
USE OF BAFFLES TO SUPPRESS ENERGY DISSIPATION IN LIQUID FILLED PRECESSING CAVITIES
James P. Vanyo and Peter W. Likins 14 Jun. 1973 29 p refs Backup document for AIAA synoptic scheduled for publication in Journal of Spacecraft and Rockets in October 1973
Avail: NTIS HC $3.50

Results of earlier energy dissipation experiments using liquid-filled, precessing, spherical cavities are compared to results obtained by introducing baffles of various sizes into the spherical cavity. It is experimentally shown that energy dissipation in liquids in precessing cavities can be significantly reduced by the addition of fine mesh baffling into the cavity. A contrary effect can be achieved by using relatively large mesh baffles such that the nonspherical cells induce turbulence and larger energy dissipation rates than the smooth walled spherical cavity. The fine mesh baffles restrict the growth of turbulence and achieve energy dissipation rates one to two orders of magnitude smaller than for the unbaffled tank. Use of the energy sink criteria for satellite attitude stability analyses indicates the desirability of using fine mesh baffles in liquid fuel tanks aboard inertially prolate or dual spin satellites. Author

N73-25281*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace Engineering.
TURBULENT MIXING OF MULTIPLE, CO-AXIAL HELIUM JETS IN A SUPERSONIC AIR STREAM
A. K. Lorber and J. A. Schetz Mar. 1973 56 p refs
(Contract NAS1-10233)
(NASA-CR-112292) Avail: NTIS HC $5.00 CSCL 20D

An experimental study of a strut-mounted, five-port, coaxial gaseous fuel injector assembly in a Mach 4 air stream with P sub o = 145 psia and T sub o = 546 R was conducted. Helium was used as the injectant, and the interjet spacing was the main parameter varied. The principal data are in the form of helium concentration profiles at six axial stations and pitot pressure profiles at two axial stations. Schlieren photographs are also presented. The slight sensitivity of the mixing rate to decreased interjet spacing was determined in the range 3.5 < or = to S/D < or = to 5.0. Author

N73-25282# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
NONLINEAR DYNAMICS OF COLLECTIVE MODES
Robert Zwanzig Apr. 1971 29 p refs Presented at IUPAP Intern. Conf. on Statist. Mech., Chicago, 1971
(Grant NSF GP-12591)
(BN-695) Avail: NTIS HC $3.50

The dynamics of collective modes in liquids are investigated. In particular, presentation is made of a method for treating nonlinear interactions between collective modes, and an application of this method to a problem of current interest is provided. Author

N73-25283*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL AND EXPERIMENTAL STUDIES OF SHOCK INTERFERENCE HEATING IN HYPERSONIC FLOWS
J. Wayne Keyes and Frank D. Hains Washington May 1973 141 p refs
(NASA-TN-D-7139; L-8423) Avail: NTIS HC $3.00 CSCL 20D

An analytical and experimental study is presented of the aerodynamic heating resulting from six types of shock interference patterns encountered in high speed flow. Centerline measurements of pressure and heat transfer distributions on basic bodies were obtained in four wind tunnels for Mach numbers from 6 to 20, specific heat ratios from 1.27 to 1.67, and free stream Reynolds numbers from 3 million to 25.6 million per meter. Peak heating

and peak pressures up to 17 and 7.5 times stagnation values, respectively, were measured. In general, results obtained from semiempirical methods developed for each of the six types of interference agreed with the experimental peaks. Author

N73-25284*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RETRIEVAL OF DISPERSIVE AND CONVECTIVE TRANSPORT PHENOMENA IN FLUIDS USING STATIONARY AND NONSTATIONARY TIME DOMAIN ANALYSIS
J. Briscoe Stephens and Robert M. St.John (Oklahoma Univ., Norman) Washington May 1973 104 p refs
(NASA-TN-D-7240; M-106) Avail: NTIS HC $3.00 CSCL 20D

Simultaneously occurring dispersive and convective components of fluid kinematics are obtained by a time domain analysis of optically retrieved temporal histories of the transport phenomena. Utilizing triangulation of collimated optical fields of view from two radiometers to obtain the temporal histories of the intensity fluctuations associated with the transport phenomena has enabled investigators to retrieve the local convective transport by employing correlation statistics. The location of the peak in the covariance curve determines the transit time from which the convection velocity is calculated; whereas, the change in shape of the peak in the covariance curve determines the change in average frequency of the wave packet from which the dispersion velocity is calculated. Thus, the two-component analysis requires the maximum possible enhancement of the delineation for the transport. The convection velocity is the result of a fixed reference frame calculation, whereas, the dispersion velocity is the result of a moving reference frame calculation. This moving reference frame is constrained to move along the common streamline at the convection velocity. The transport probability was developed as an estimate of whether the transport phenomena have been measured along the common stream, and also provides an indication of whether the period of stationarity is sufficient to provide adequate information enhancement. The time information is suppressed by the utilization of a fourth-order autocovariance curve. Author

N73-25285*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER PROGRAMS FOR PREDICTING SUPERSONIC AND HYPERSONIC INTERFERENCE FLOW FIELDS AND HEATING
Dana J. Morris and J. Wayne Keyes Washington May 1973 158 p refs
(NASA-TM-X-2725; L-8547) Avail: NTIS HC $3.00 CSCL 20D

This report describes computer codes which calculate two-dimensional shock interference patterns. These codes compute the six types of interference flows as defined by Edney (Aeronaut. Res. Inst. of Sweden FAA Rep. 115). Results include properties of the inviscid flow field and the inviscid-viscous interaction at the surface along with peak pressure and peak heating at the impingement point. Author

N73-25286*# LTV Aerospace Corp., Dallas, Tex. Vought Systems Div.
APPLICATION OF THE METHOD LOCAL POTENTIAL TO THE ANALYSIS OF TURBULENT SHEAR FLOWS Final Report, Jun. 1972 - Mar. 1973
T. D. Reed Mar. 1973 30 p refs
(Contract NAS1-11666)
(NASA-CR-112322) Avail: NTIS HC $3.50 CSCL 20D

It has been found that, in general, the local potential cannot be employed to obtain approximate solutions for the various correlations of turbulent properties which appear in the time averaged form of the conservation equations. Although the method of local potential is equivalent to the Galerkin method when the self-consistent condition is applied, the local potential can also be applied as an iterative algorithm in place of using the selfconsistent condition. This procedure offers an alternative to the Galerkin method and may be useful in obtaining approximate solutions for the total turbulent velocity. In addition, for certain simple turbulent shear flows the iterative algorithm may permit approximate, but non-empirical, solutions by modeling only the mean velocity and the Reynolds stress. Author

N73-25287*# Southwest Research Inst., San Antonio, Tex.
EXPERIMENTAL INVESTIGATION OF LIQUID PROPELLANT DYNAMICS IN A DOUBLE CYLINDRICAL TANK Final Report
Guido F. Ransleben, Jr. May 1973 42 p refs
(Contract NAS8-28086; SwRI Proj. 02-3363)
(NASA-CR-124277) Avail: NTIS HC $4.25 CSCL 20D

Experimental data are presented for verifying the computer program for computing propellant oscillation modes and frequencies for tanks of any shape, fill level, or orientation. The experimental apparatus including the tank, support and excitation system, and instrumentation is described along with the procedures. Results showing slosh forces and moments are tabulated for different fill heights. It was found that for the vertical tank excited along the long axis, the frequencies of the higher modes are significantly higher than with the tank tilted. Little difference was noted for excitation along the short axis. F.O.S.

N73-25288# Institut Franco-Allemand de Recherches, St. Louis (France).
USE OF MICROWAVE REFLECTION TO DETERMINE EQUILIBRIUM ELECTRON DENSITY BEHIND A SHOCK WAVE REFLECTED IN THE AIR [BESTIMMUNG DER GLEICHGEWICHTSELEKTRONENDICHTE HINTER EINER REFLEKTIERTEN STOSSWELLE IN LUFT DURCH MIKROWELLENREFLEXION]
H. Nett 30 Dec. 1971 27 p refs In GERMAN
(Contract DTEN-70/70/198)
(ISL-43/71) Avail: NTIS HC $3.50

Electron density measurements in the thermodynamic equilibrium behind a reflected shock wave in air were carried out in order to investigate the ionized wake of hypervelocity projectiles. The shock tube in which the measurements were performed and a simple microwave reflectometer are described briefly. A comparison of the results with theoretic literature values of the equilibrium electron density behind reflected shock waves in air shows good agreement for the shock Mach number range. ESRO

N73-25289# Army Foreign Science and Technology Center, Charlottesville, Va.
UNCONDITIONAL STABILITY OF THERMOHYDRODYNAMIC SYSTEMS WITH CONCENTRATED LOADS
7 Mar. 1973 25 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Sibirskoe Otd., no. 13, Ser. Tekhn. Nauk (Moscow), no. 3, 1970
(AD-758748; FSTC-HT-23-1197-72) Avail: NTIS CSCL 20/4

Consideration is given to a thermodynamic system in the form of a channel with a variable cross-section area, in which gas flows and such processes occur as heat exchange and mass exchange with the external medium, combustion or other chemical conversions, etc. These processes like the changing areas of the cross-section are designated as loads on the thermodynamic system. A wave process in the thermodynamic system is considered, which consists of n links which are connected with one another and with the external medium by the nodes, in sections, in which concentrated loads are applied to the system. (Author Modified Abstract) GRA

N73-25290# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
STABILITY OF LIQUID FILMS ADJACENT TO COMPRESSIBLE STREAMS
Gary L. Bordner, Ali Hasan Nayfeh, and William S. Saric (Sandia Labs., Albuquerque, N. Mex.) Jan. 1973 37 p refs
(Contract N00014-72-A-0136-0002)
(AD-758982; VPI-E-73-3) Avail: NTIS CSCL 20/4

An analysis is presented for the linear stability of a liquid film adjacent to a compressible viscous gas stream. The analysis is valid for all wavelengths and liquid Reynolds numbers. The pressure and shear perturbations exerted by the gas on the liquid are calculated using a gas model which takes into account the gas viscosity, velocity profile, and heat transfer. The results show that an inviscid uniform stream model for the gas is inadequate unless the disturbed boundary layer is very thin. Although the present linear analysis is in fairly good agreement with the experimental observations for subsonic flow, it does

not predict the observed wavelengths and wave speeds for supersonic flow. Author (GRA)

N73-25291# Hydronautics, Inc., Laurel, Md.
THE USE OF SHIP MODEL BASINS FOR THE STUDY OF VORTEX WAKE PHENOMENA
Clinton E. Brown Mar. 1973 33 p refs
(Contract F44620-71-C-0080; AF Proj. 9781)
(AD-758893; TR-7115-2; AFOSR-73-0567TR) Avail: NTIS CSCL 14/2

The basic differences between tests in air and in water are discussed relative to the study of aircraft vortex wake phenomena. It is shown that use of large ship model basins is valid for simulation up to critical Mach numbers of flight. Free surface interference is shown to be negligible for tests made at sufficient towing depths and is avoided at typical towing speeds. Effects of Reynolds number mismatch on the test results is analyzed and it is concluded that wing profile drag coefficients should be matched between full and model scale. Consideration is given to the problem of stopping and starting disturbances in towed-model testing. (Author Modified Abstract) GRA

N73-25292# Illinois Inst. of Tech., Chicago. Dept. of Mechanics Mechanical and Aerospace Engineering.
AN APPROACH TO FLOW ENGINEERING VIA FUNCTIONAL FLOW MODULES
Mark V. Morkovin 1972 35 p refs
(Contract F44620-69-C-0022; AF Proj. 9560)
(AD-758894; IIT-THEMIS-R72-1-1972; AFOSR-72-0908TR) Avail: NTIS CSCL 20/4

Complex three dimensional flow fields are seen to consist of identifiable, morphologically invariant, mildly interacting, flow structures or modules. Outputs of such flow fields such as wind loads, heat and mass transfer, flow quality, mixing, and pressure losses can be rationally established and with a knowledge of the modular structure. The paper discusses the modular approach for the case of flows around three-dimensional obstacles in boundary layers and for the case of tailoring free-stream flow and turbulence by flow inserts such as screens, perforated plates, honeycombs and foam slabs. (Author Modified Abstract) GRA

N73-25293# Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics.
OPTICAL MEASUREMENTS AND MICROWAVE MEASUREMENTS BEHIND SHOCK WAVES Final Report, 1 Jul. 1970 - 30 Jun. 1972
William Low Nov. 1972 55 p refs
(Grant EOOAR-0080-70; AF Proj. 9783)
(AD-757230; AFOSR-73-0440TR) Avail: NTIS CSCL 07/4

The report presents partial texts of the author's 1971/72 papers. Their titles are: Measurements of diaphragm opening times in shock tubes; Spectroscopic and kinetic studies of N2 - O2 mixtures in shock waves at Mach no. 9; Attenuation measurements on narrow shock tubes at Mach no. 8 - 11; and Atomic oxygen formation times obtained from measurements of electron density profiles behind shock waves in air. (Author Modified Abstract) GRA

N73-25294# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
LIQUID IMPACT ROUND ROBIN TEST RESULTS FROM REPEATING WATER JET GUN DEVICE OF THE UNIVERSITY OF MICHIGAN FOR ASTM COMMITTEE G-2 ON EROSION AND WEAR
J. B. Hwang and F. G. Hammitt Jan. 1973 30 p ref
(Grant NSF GK-1889)
(PB-215631/3; UMICH-01357-25-T) Avail: NTIS HC $3.00 CSCL 20D

The tests herein reported were conducted with the repeating water jet gun device upon materials supplied in connection with the liquid impact round-robin program on erosion and wear. Various materials and impact velocities were included as listed in Table 1. These are plexiglass, two aluminum alloys, commercially pure nickel, 316 SS, and Stellite 6B. Author (GRA)

N73-25295# Woods Hole Oceanographic Institution, Mass.
NOTES ON THE 1972 SUMMER STUDY PROGRAM IN GEOPHYSICAL FLUID DYNAMICS. VOLUME 2: FELLOW-SHIP LECTURES
1972 117 p refs Conf. held at Woods Hole, Mass., 1972 2 Vol.
(Grant NSF GZ-1494)
(PB-214660/3; WHOI-Ref-72-79-Vol-2) Avail: NTIS HC $3.00 CSCL 20D

The following topics are discussed: (1) Baroclinic flow over an obstacle in a rotating system; (2) Thermal and Taylor instabilities in a rapidly rotating annulus; (3) Taylor columns for small Rossby numbers; (4) Rectified currents generated by waves and topography; (5) Taylor columns and Rossby wakes generated by isolated topographic features on a beta-plane; (6) the determination of internal wave parameters; (7) The calculation of nonlinear interfacial waves. Author (GRA)

N73-25296# Woods Hole Oceanographic Institution, Mass.
NOTES ON THE 1972 SUMMER STUDY PROGRAM IN GEOPHYSICAL FLUID DYNAMICS. VOLUME 1: SEMINARS, COURSE LECTURES AND ABSTRACTS
1972 155 p refs Conf. held at Woods Hole, Mass., 1972 2 Vol.
(Grant NSF GZ-1494)
(PB-214659/5; WHOI-Ref-72-79-Vol-1) Avail: NTIS HC $3.00 CSCL 20D

The effect of gravity on fluids of varying density is of fundamental importance in natural flows. This subject formed the topic of concentration for the fourteenth summer program in Geophysical Fluid Dynamics at the Woods Hole Oceanographic Institution. Seminars were given on the following topics: The Boussinesq approximation; small amplitude internal gravity waves; wave-wave interaction; the effects of stratification on rotating critical flow; experiments in stratified fluids; and double diffusive convection. GRA

N73-25297# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
FLOW FIELDS IN WALL JET RECEIVERS WITH RIGHT ANGLE SPILL FLOW AT THE ENTRANCE
S. J. Bach and D. O. Rockwell Feb. 1973 76 p refs
(Contract N00014-69-A-0417)
(AD-759796; THEMIS-LU-TR-14) Avail: NTIS CSCL 20/4

Flow issuing from a nozzle in fluid amplifiers and impinging on a receiver with a spill port oriented at 90 degree with respect to the direction of the through flow was investigated. The effects of receiver width and length on the flow field were studied for a range of downstream receiver loading conditions varying from fully open to completely blocked. Velocity, wall static, and total pressure distributions were acquired. It was found that the receiver exit static pressure recovery coefficient increased with increasing spill flow up to a critical value of spill flow at which the jet switched to the spill port side of the receiver. Switching was investigated at low spill flow ratios for cases of large setback. (Author Modified Abstract) GRA

N73-25298# Technology, Inc., Dayton, Ohio.
TURBULENT JET CALCULATIONS
Hermann Viets Wright-Patterson AFB, Ohio Apr. 1973 23 p refs
(Contract F33615-71-C-1463; AF Proj. 7116)
(AD-759576; ARL-73-0058) Avail: NTIS CSCL 20/4

The effectiveness of several simple eddy viscosity models depending solely on the local mean flow properties is examined for coaxial and two-dimensional jets with and without coflowing stream. It is shown that a simple modification of the classic Prandtl model leads to improved agreement in the case of a non zero coflowing stream. Author (GRA)

N73-25299# General Electric Co., Schenectady, N.Y. Research and Development Center.
APPLICATION OF LIGHT-SCATTERING TECHNIQUES FOR MEASUREMENTS OF DENSITY, TEMPERATURE, AND VELOCITY IN GASDYNAMICS Final Report, 1 Jul. 1971 - 1 Apr. 1972
M. Lapp, C. M. Penny, and J. A. Asher Wright-Patterson AFB, Ohio ARL Apr. 1973 167 p refs
(Contract F33615-71-C-1867; AF Proj. 7065)
(AD-759575; SRD-72-085; ARL-73-0045) Avail: NTIS CSCL 20/4

Methods based upon light-scattering techniques for the three-dimensional measurement of density, temperature, and velocity are evaluated for application to wind tunnel studies over wide ranges of the state variables for air: 0.001 to 100 psia, 30 to 2000R, and 0 to 5000 feet per second. Recommended approaches are laser Doppler velocimetry for velocity measurement and rotational and vibrational Raman scattering for temperature and density measurement. The laser Doppler velocimeter technique is in an advanced stage of development and its implementation is discussed in detail. The Raman approach is innovative and has been selected on the basis of potential advantages over alternative approaches. Although the projected capabilities are analyzed and presented in detail, the recommended system has not as yet been implemented in the laboratory. The Raman techniques are shown to be applicable over the entire range of flow parameters, which correspond to the pressure-temperature loci from stagnation conditions to the design point for the three major test facilities under consideration at Wright-Patterson Air Force Base. (Author Modified Abstract) GRA

N73-25300# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Hypersonic Research Lab.
RAREFIED GASDYNAMICS . Final Report
James S. Petty Feb. 1973 19 p refs
(AF Proj. 7064)
(AD-759165; ARL-73-0012) Avail: NTIS CSCL 20/4

In a study of basic phenomena in rarefied gas flows, particular attention was given to transport phenomena. Principal items of research included studies of the rarefied Rayleigh problem, Pouiselle-like flow, anomolous heat transfer, normal shock reflection, and a state-of-the-art survey of rarefied gas-dynamics. (Author Modified Abstract) GRA

N73-25301# Naval Ordnance Lab., White Oak, Md.
AN APPROXIMATE CALCULATION OF HEAT TRANSFER IN TRANSPIRED BOUNDARY LAYERS
Tse-Fou Zien 1 Feb. 1973 71 p refs
(AD-759353; NOLTR-73-17) Avail: NTIS CSCL 20/4

An approximate method of calculating the surface heat transfer in a transpired boundary layer is presented. The method is based on an idea for refining the momentum integral technique. A semi-infinite, isothermal flat plate with uniform surface mass flux is used to demonstrate the method. The flow is assumed to be laminar. Results are presented for both incompressible and compressible boundary layers, and comparisons are made with numerical solutions or other approximate results. The findings are indicative of the potential of the method for development into an efficient tool for studying boundary-layer flows of a more complex nature. (Author Modified Abstract) GRA

N73-25302# Naval Ordnance Lab., White Oak, Md.
VERTICAL WATER ENTRY OF FINITE CONES: A NUMERICAL CALCULATION
Kenneth D. Shere and Michael J. VanderVorst 6 Feb. 1973 45 p refs
(AD-759006; NOLTR-73-22) Avail: NTIS CSCL 16/2

In the report a numerical solution of the impact phase during vertical water-entry of a finite cone is presented. The hydrodynamic code, MACWET, which calculates the solutions, utilizes an extension of the marker and cell method. The following examples are included: (1) a constant velocity cylinder impacting at 131 ft/sec; (2) a three inch (radius), 90 degrees steel cone falling from rest with its vertex barely submerged in the water; (3) a three inch, 90 degrees steel cone impacting at 131 ft/sec; and (4) a 136 lb., nine inch, 90 degrees cone impacting at 40 ft/sec. (The code is not limited to 90 degrees cones). The numerical results are compared with available experimental data. Author (GRA)

N73-25303# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STUDY OF A CIRCUMFERENTIALLY NONUNIFORM FLOW IN FRONT OF AN AXIAL FLOW COMPRESSOR STAGE
S. I. Ginzburg and L. A. Suslennikov 23 Mar. 1973 31 p refs Transl. into ENGLISH from Lopatochnye Mashiny i Struynye App. (USSR), no. 5, 1971 p 55-76
(FTD Proj. T71-04-03)
(AD-759247; FTD-MT-24-1787-72) Avail: NTIS CSCL 13/7

The question of the operation of an axial-flow compressor in a circumferentially nonuniform flow is of considerable practical interest both with respect to the effect of nonuniformity on the gas-dynamic parameters of the stages and their stability and with respect to the determination of the variable forces which arise on the impeller blades. GRA

N73-25304# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GASDYNAMICS AND HEAT TRANSFER, SELECTED ARTICLES
I. P. Ginzburg 28 Mar. 1973 49 p refs Transl. into ENGLISH from Leningrad Univ. Uchenye Zapiski (USSR), no. 3, 1970 p 55-81, 114-119
(AD-759240; FTD-MT-24-1667-72) Avail: NTIS CSCL 20/4

Contents: The analysis of compound jets; calculation of the base pressure during the discharge of a series of jets; certain problems of the interaction of compound jets; ejection from closed volume in the presence of the coniform offtake. GRA

N73-25305# Illinois Inst. of Tech., Chicago. Dept. of Mechanics, Mechanical and Aerospace Engineering.
CONFINED MIXING OF MULTIPLE JETS
G. Fabris and Andrew A. Fejer Nov. 1972 27 p refs
(Contract F44620-69-C-0022; AF Proj. 7921)
(AD-758836; THEMIS-ITT-R72-10-Nov-72;
AFOSR-73-0591TR) Avail: NTIS CSCL 20/4

The study deals with the transfer of kinetic energy from an array of primary jets to a surrounding secondary stream. It explores the basic features of such flows and examines to what extent the results of single jet research may be applied to multiple jet configurations. It presents an analytical technique for estimating the performance of multiple jets and examines in a special multiple - jet test facility the validity of the assumptions used in the analysis. (Author Modified Abstract) GRA

N73-25306# Texas Univ., Austin. Dept. of Mechanical Engineering.
AN INVESTIGATION OF THE DYNAMIC RESPONSE OF ANALOG FLUID AMPLIFIERS Final Report, Sep. 1971 - Dec. 1972
A. J. Healey Dec. 1972 7 p refs
(Grant DA-ARO(D)-31-124-72-G10)
(AD-759211; AROD-10300-2-E) Avail: NTIS CSCL 13/7

The broad aim of the report is to provide information leading to an improved understanding of the steady state and dynamic performance of beam-deflection fluid amplifiers. This program is theoretical and experimental. The theoretical part is concerned with the development of an adequate amplifier dynamic model to project the effects of loading and geometric design on response. The experimental part is concerned with an investigation of the pressure and flow recovery process and the spillover jet characteristics of fluid amplifier receivers. This information is needed to formulate the details of an adequate dynamic model. GRA

N73-25307# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Hypersonic Research Lab.
COMPRESSIBLE TURBULENT BOUNDARY LAYER SOLUTIONS EMPLOYING EDDY VISCOSITY MODELS
J. S. Shang, Wilbur L. Hankey, Jr., and Douglas L. Dwoyer Mar. 1973 72 p refs
(AF Proj. 7064)
(AD-759164; ARL-73-0041) Avail: NTIS CSCL 20/4

The purpose of the investigation is to compare and summarize the classic eddy viscosity models in an attempt to establish a bench mark for future development of turbulent boundary layer research. Several multilayer eddy viscosity models were selected on the basis of their basic approximation of the viscous sublayer region and the eddy viscosity model when necessary to improve the accuracy of the solutions. Calculations were performed over Mach number ranges of approximately zero to 4.55 for zero pressure gradient and adiabatic wall. A study of transition location was also accomplished. (Author Modified Abstract) GRA

N73-25308# Naval Postgraduate School, Monterey, Calif.
AN ANALYTICAL STUDY OF INCOMPRESSIBLE FREE TURBULENT MIXING IN ADVERSE AND FAVORABLE PRESSURE GRADIENTS
Gustave Hokenson Feb. 1973 50 p refs
(AD-758664; NPS-57HW73021A) Avail: NTIS CSCL 20/4

The equations governing free turbulent mixing are derived from the Navier-Stokes equations and transformed into a mathematical plane which is explicitly independent of the eddy viscosity model. The coupled momentum and turbulent kinetic energy equations are analytically solved in the transformed plane by a perturbation technique and subsequently retransformed into physical space based on a hypothesized dependence of the eddy viscosity on the turbulent kinetic energy. The adequacy of a given model in reproducing the velocity and turbulent kinetic energy field is assessed by comparing the results of the analysis with some experimental data of planar turbulent wake mixing in constant adverse and favorable pressure gradients.

Author (GRA)

N73-25309# Iowa Inst. of Hydraulic Research, Iowa City.
ON THE EQUATIONS OF A THICK AXISYMMETRIC TURBULENT BOUNDARY LAYER
V. C. Patel Jan. 1973 32 p refs
(Contract N00014-68-A-0196-0002)
(AD-759015; IIHR-143) Avail: NTIS CSCL 20/4

An examination of the Reynolds equations for axisymmetric turbulent flow where the thickness of the boundary layer is of the same order as the transverse radius of curvature of the surface shows that neither the boundary layer nor the potential flow outside it may be calculated independently of the other, owing to significant interactions between the two flow regimes. Following a discussion of various procedures for extending conventional thin boundary layer calculation methods to treat thick axisymmetric turbulent boundary layers, a method is proposed for the simultaneous solution of the boundary layer and the potential flow equations, allowing the two flow regimes to interact. (Author Modified Abstract) GRA

N73-25310# Iowa Inst. of Hydraulic Research, Iowa City.
AN EXPERIMENTAL STUDY OF THE THICK TURBULENT BOUNDARY LAYER NEAR THE TAIL OF A BODY OF REVOLUTION
V. C. Patel, A. Nakayama, and R. Damian Jan. 1973 55 p refs
(Contract N00014-68-A-0196-0002)
(AD-759014; IIHR-142) Avail: NTIS CSCL 20/4

Detailed measurements of pressure distributions, mean velocity profiles and Reynolds stresses were made in the thick incompressible axisymmetric turbulent boundary layer near the tail of a body of revolution. The results indicate a number of important differences between the behavior of a thick and a thin boundary layer. Significant variations of static pressure and a low level of turbulence are noted. Thus in order to predict the behavior of the flow in the tail region of a body of revolution it does not appear possible to use conventional thin-boundary-layer calculation procedures. (Author Modified Abstract) GRA

N73-25311# Illinois Inst. of Tech., Chicago. Dept. of Mechanics, Mechanical and Aerospace Engineering.
FLOW VISUALIZATION TECHNIQUES FOR THE STUDY OF THE AERODYNAMICS OF BLUFF BODIES AND OF UNSTEADY FLOWS
Andrew A. Fejer Feb. 1972 42 p refs
(Contract F44620-69-C-0022; AF Proj. 9560)
(AD-759266; AFOSR-72-0907TR) Avail: NTIS CSCL 20/4

Existing flow visualization techniques are considered which are relevant to the study of wind effects on bluff bodies. A number of these are described in some detail; in particular, smoke filaments, dye streaks, wall tracers, hydrogen bubbles and tufts. Representative examples of the application of these techniques are presented. The paper has been prepared for presentation in a 1972 lecture series on wind effects on buildings and structures held at the Von Karman Institute, Rhode-St.-Genese. (Author Modified Abstract) GRA

N73-25312# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
HYDROFOIL DESIGN FOR MINIMUM CONTROL POWER Final Report, Jul. 1970 - Oct. 1972
Paul J. Remington and Erich K. Bender 28 Feb. 1973 136 p refs
(Contract N00014-70-C-0032)
(AD-759286; BBN-2511) Avail: NTIS CSCL 13/10

The power requirements for control of a hydrofoil ship in a random sea are examined using control systems designed through minimization of a cost function consisting of a linear combination of heave acceleration and control power. Four hydrofoil configurations are compared using ship parameters representative of the USS PLAINVIEW, a 300 ton U.S. Navy hydrofoil ship in which ship pitch dynamics have been neglected. It is found that a configuration consisting of a pivoted foil with a trailing edge tab for incidence angle control consumes the least power for a given ship response followed by a configuration consisting of a fixed foil with a trailing edge flap. (Author Modified Abstract) GRA

N73-25313# Technology, Inc., Dayton, Ohio.
AN EXPERIMENTAL INVESTIGATION OF A VORTEX STABILIZED ARC IN AN AXIAL MAGNETIC FIELD Final Report
Gordon L. Cann Wright-Patterson AFB, Ohio ARL Mar. 1973 106 p refs
(Contract F33615-71-C-1463; AF Proj. 7065)
(AD-759187; ARL-73-0043) Avail: NTIS CSCL 13/1

An experimental program has been conducted to investigate the physical processes occurring in vortex stabilized arcs, with and without an applied axial magnetic field. Arc temperature measurements indicate centerline temperature to be insensitive to arc current and chamber pressure. Centerline temperature was found to decrease when arc length was increased, when orifice area was decreased and when axial magnetic field strength was increased. Magnetic field strength could only be increased to a critical value, at which point the discharge moved off the centerline line of the chamber and attached to its walls. A stability criterion has been derived to estimate the strength of the critical magnetic field. Experimental data agrees very well with the derived expression. (Author Modified Abstract) GRA

N73-25314# Lockheed Missiles and Space Co., Sunnyvale, Calif.
AN EXPERIMENTAL STUDY OF THE VENTILATION OF BLUNT BASED SURFACE PIERCING STRUTS Final Report, Nov. 1971 - Dec. 1972
Ray L. Kramer Nov. 1972 60 p refs
(Contract N00014-72-C-0091)
(AD-759046; LMSC-TM-5774-72-19; LMSC-D311609) Avail: NTIS CSCL 13/10

An experimental program was conducted in the Lockheed Underwater Missile Facility to investigate the ventilation characteristics for surface-piercing blunt-based struts in calm water and in waves. Struts with two leading-edge configurations, one sharp and one blunt, were tested, and the ventilation characteristics are compared with those previously obtained for struts with streamlined trailing edges to determine the effects of the blunt base. The experiments were performed at low ambient pressures to obtain ventilation inception under simultaneous Froude and cavitation number scaled conditions. Performance comparisons are made at strut yaw angles of six and eight degrees on the bases of resistance to ventilation and of the effects on hydrodynamic forces when ventilation occurs. (Author Modified Abstract) GRA

N73-25315# Texas Univ., Austin. Dept. of Mechanical Engineering.
STATIC OUTPUT CHARACTERISTICS OF A BEAM DEFLECTION FLUID AMPLIFIER
Anthony J. Healey and William J. Reynolds Dec. 1972 107 p refs
(Grant DA-ARO(D)-31-124-72-G10)
(AD-759210; AROD-10300-1-E) Avail: NTIS CSCL 13/7

A large scale model of a fluid amplifier was investigated to determine the receiver pressure, receiver flow, and vent flow characteristics for different values of power jet deflection and

receiver loading. The differential pressure gain of the model was found to be the largest when the receiver load obstructed approximately 70% of the receiver output area. Limited experiments performed to determine the effect of the receiver-vent geometry on the blocked load pressure recovery showed that an open center dump and a slight sweepback of the exterior receiver wall improved the gain and the linearity of the differential pressure recovery characteristic. A control volume analysis used to predict the receiver pressures and flows yielded results which agreed reasonably well with experimental values for small receiver loads. Author (GRA)

N73-25316# Defence Research Establishment Valcartier (Quebec).
ELECTRON DENSITY BEHAVIOR IN THE WAKE OF SPHERES FLOWN AT 14500 FEET/SECOND
D. Heckman, L. Sevigny, A. Fitchett, A. Emond, and P. Doyon Dec. 1972 185 p refs
(Contract DAHC01-69-C-0921; ARPA Order 133)
(AD-759065; DREV-R-680/72) Avail: NTIS CSCL 19/1

The amplitudes and widths of the assumed Guassian distributions of electron density in the wakes of hypersonic spheres flown at 14,500 feet/second in atmospheres of air and nitrogen at various pressures have been derived from phase shift measurements with a dual channel interferometer. The data apply to the near wake extending from just behind the spherical projectile out to several hundreds of body diameters. (Author Modified Abstract) GRA

N73-25317# Defence Research Establishment Valcartier (Quebec).
CONE WAKE VELOCITY PROFILES MEASURED BY MEANS OF THE SEQUENTIAL SPARK TECHNIQUE
C. Lahaye Dec. 1972 78 p refs
(Contract DAHC01-69-C-0921; ARPA Order 133)
(AD-759159; DREV-TN-2029/72) Avail: NTIS CSCL 16/3

The purpose of this note is to document on the velocity profiles measured with the sequential spark technique during the program of study of cone wakes. The use of these profiles has been limited to the determination of characteristics of wake axis and wake front velocities and to the visualization of the skewness of the transverse profile of axial velocity. The results contain additional information on the wake structure which cannot be extracted presently because of lack of statistical data but which could be of interest to specialists in the field. (Author Modified Abstract) GRA

N73-25318# Office of Naval Research, London (England).
NUMERICAL CALCULATION OF VISCOUS FLUID PROBLEMS AT IMPERIAL COLLEGE, LONDON
David F. Dyer 1 Mar. 1973 17 p refs
(AD-758078; ONRL-R-2-73) Avail: NTIS CSCL 20/4

The report discusses the current research program in numerical analysis of fluid mechanic problems by Professor Spalding's group at Imperial College, London, England. Typical results for calculations of flow over steps, furnace performance, wall roughness effects, etc., are given. (Author Modified Abstract) GRA

N73-25319# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL CALCULATION OF CERTAIN TWO-DIMENSIONAL MAGNETOHYDRODYNAMIC FLOWS IN CHANNELS
A. V. Gubarev, L. M. Degtyarev, A. A. Samarskii, and A. P. Favorskii Apr. 1973 86 p refs Transl. into ENGLISH from the book "Chislennyi Raschet Nekotorykh Dvumernykh Magnitogridodinamich. Techenii v Kanalakh" Moscow, 1971 p 1-64
(AF Proj. 3145)
(AD-759424; FTD-MT-24-1743-72) Avail: NTIS CSCL 20/9

The paper presents results of the numerical study of the stagnation of a supersonic flow of conducting gas in magnetohydrodynamic channels. Small magnetic Reynolds numbers are assumed. The effect of the longitudinal end effect and Hall effect on the two-dimensional flow structure at a finite value of the parameter of interaction is investigated. Author (GRA)

N73-25320# State Univ. of New York, Buffalo. Fluid and Thermal Sciences Lab.
ANALYSIS OF LAMINAR BOUNDARY LAYERS IN NON-CENTERED UNSTEADY WAVES
J. Gordon Hall, G. Srinivasan, and Jaipal S. Rathi Feb. 1973 49 p refs
(Contract N00014-72-C-0373; NR Proj. 061-207)
(AD-759768; FTSL-TR-73-1) Avail: NTIS CSCL 20/4

The present study analyzes non-centered expansion and compression wave geometry and its influence on the laminar boundary layer. (Author Modified Abstract) GRA

N73-25001 Ministry of Aviation, London (England).
THE EFFECT OF A CENTRAL JET ON THE BASE PRESSURE OF A CYLINDRICAL AFTER-BODY IN A SUPERSONIC STREAM
J. Reid and R. C. Hastings *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 21-61 refs Previously issued as RAE-Aero-2621; ARC-21-796 (For availability see N73-24999 16-01)
(ARC-R/M-3224; RAE-Aero-2621; ARC-21796)

N73-25002 National Physical Lab., Teddington (England). Aerodynamics Div.
OBSERVATIONS OF THE FLOW OVER A TWO DIMENSIONAL 4 PERCENT THICK AEROFOIL ATTRANSONIC SPEEDS
B. D. Henshall and R. F. Cash *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 63-81 refs (For availability see N73-24999 16-01)
(ARC-R/M-3180)

N73-25005 Ministry of Aviation, London (England).
THE INTERFERENCE ON A THREE DIMENSIONAL JET FLAP WING IN A CLOSED WIND TUNNEL
E. C. Maskell *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 143-154 refs Previously issued as RAE-TN-Aero-2650; ARC-21598 (For availability see N73-24999 16-01)
(ARC-R/M-3219; RAE-TN-Aero-2650; ARC-21598)

N73-25013 Ministry of Supply, London (England).
THE GROWTH OF COMPRESSIBLE TURBULENT BOUNDARY LAYERS ON ISOTHERMAL AND ADIABATIC WALLS
D. A. Spence *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 463-477 refs (For availability see N73-24999 16-01)
(ARC-R/M-319; RAE-Aero-2619)

N73-25014 Ministry of Supply, London (England).
AN AXIALLY SYMMETRIC ANALOGUE FOR GENERAL THREE DIMENSIONAL BOUNDARY LAYERS
J. C. Cooke *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 479-490 refs (For availability see N73-24999 16-01)
(ARC-R/M-3200; RAE-TN-Aero-2625)

N73-25015 Ministry of Supply, London (England).
APPROXIMATE CALCULATION OF THREE DIMENSIONAL LAMINAR BOUNDARY LAYERS
J. A. Cooke *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 491-520 refs (For availability see N73-24999 16-01)
(ARC-R/M-3201; RAE-TN-Aero-2658)

N73-25016 National Physical Lab., Teddington (England). Aerodynamics Div.
THE DETERMINATION OF LOCAL TURBULENT SKIN FRICTION FROM OBSERVATIONS IN THE VISCOUS SUBLAYER
P. Bradshaw and N. Gregory *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 521-536 refs (For availability see N73-24999 16-01)
(ARC-R/M-3202)

N73-25017 Ministry of Supply, London (England).
THE CALCULATION OF THE COMPRESSIBLE TURBULENT

BOUNDARY LAYER IN AN ARBITRARY PRESSURE GRADIENT: A CORRELATION OF CERTAIN PREVIOUS METHODS
B. S. Stratford and G. S. Beavers *In* ARC Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 537-556 refs Previously issued as NGTE-M-330; ARC-21399 (For availability see N73-24999 16-01)
(ARC-R/M-3207; NGTE-M-330; ARC-21399)

N73-25018 Aeronautical Research Council, London (England).
AN APPROXIMATE INTEGRAL METHOD FOR CALCULATING THE INCOMPRESSIBLE LAMINAR BOUNDARY LAYER ON AN INFINITE SWEPT WING ON WHICH VELOCITY AND SUCTION DISTRIBUTION ARE ARBITRARY
H. G. Pinsent and P. A. Pinsent *In its* Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 557-594 refs Previously issued as ARC-22154; RR-54 (For availability see N73-24999 16-01)
(ARC-R/M-3241; ARC-22154; RR-54)

N73-25019 Aeronautical Research Council, London (England).
EXAMPLES OF THE EFFECTS OF SHOCK INDUCED BOUNDARY LAYER SEPARATION IN TRANSONIC FLIGHT
H. H. Pearcey and D. W. Holder *In its* Aerodyn. Res., including Heating, Airfoils, and Boundary Layer Studies, Vol. 1 1971 p 595-652 refs Supersedes ARC-16446 (For availability see N73-24999 16-01)
(ARC-R/M-3510; ARC-16446)

N73-25034 National Physical Lab., Teddington (England). Aerodynamics Div.
THE NORMAL IMPINGEMENT OF A CIRCULAR AIR JET ON A FLAT SURFACE
P. Bradshaw and Edna M. Love *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1159-1166 refs Previously issued as ARC-21268 (For availability see N73-25020 16-01)
(ARC-R/M-3205; ARC-21268)

N73-25035 Ministry of Aviation, London (England).
A THEORETICAL STUDY OF ANNULAR SUPERSONIC NOZZLES
W. T. Lord *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1167-1196 Previously issued as RAE-Aero-2627; ARC-21706 (For availability see N73-25020 16-01)
(ARC-R/M-3227; RAE-Aero-2627; ARC-21706)

N73-25036 Ministry of Aviation, London (England).
ON AXISYMMETRICAL GAS JETS, WITH APPLICATION TO ROCKET JET FLOW FIELDS AT HIGH ALTITUDES
W. T. Lord *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1197-1224 refs Previously issued as RAE-Aero-2626; ARC-21535 (For availability see N73-25020 16-01)
(ARC-R/M-3235; RAE-Aero-2626; ARC-21535)

N73-25037 Ministry of Aviation, London (England).
THE PERFORMANCE OF SUPERSONIC TURBINE NOZZLES
B. S. Stratford and G. E. Sansome *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1225-1257 refs Previously issued as NGTE-R-234; ARC-21261 (For availability see N73-25020 16-01)
(ARC-R/M-3273; NGTE-R-234; ARC-21261)

N73-25038 Manchester Univ. (England). Dept. of the Mechanics of Fluids.
FURTHER RESULTS ON THE MIXING OF FREE AXIALLY-SYMMETRICAL JETS OF MACH NUMBER 1.40
N. H. Johannesen *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1259-1285 refs Previously issued as ARC-20981 (For availability see N73-25020 16-01)
(ARC-R/M-3292; ARC-20981)

N73-25042 Ministry of Aviation, London (England).
THE EFFECT OF HUMIDITY ON LAMINAR RECOVERY TEMPERATURE MEASUREMENTS IN SUPERSONIC FLOW OF AIR IN WIND TUNNELS
J. F. W. Crane *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1359-1380 refs Previously issued as RAE-Aero-2616; ARC-21822 (For availability see N73-25020 16-01)
(ARC-R/M-3215; RAE-Aero-2616; ARC-21822)

N73-25550* United Aircraft Corp., East Hartford, Conn. Research Labs.
NONDESTRUCTIVE TESTING AND FLOW VISUALIZATION: TWO AEROSPACE APPLICATIONS OF HOLOGRAPHY
R. K. Erf, R. M. Gagosz, and J. P. Waters *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 95-120 refs (For availability see N73-25540 16-16)
(Contract NAS1-9926)
CSCL 20D

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-25321 National Lending Library for Science and Technology, Boston Spa (England).
CHARACTERISTIC FEATURES OF THE ATMOSPHERIC CIRCULATION AND ITS LARGE SCALE INTERACTION WITH THE ATLANTIC OCEAN ON THE 30 DEG W MERIDIAN IN APRIL-JUNE 1970
A. L. Kac 25 Sep. 1972 25 p refs Transl. into ENGLISH from Tr. Gibrometeorol. Nauchn. - Issled. Tsentr. SSSR (Leningrad), 1971 p 41-61
(NLL-M-22854-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Two scientific expeditions made in 1969 and 1970 at an interval of exactly one year are described. Large scale variations were discovered in the Atlantic Ocean and in the atmosphere along the 30 deg W meridian in both hemispheres. It was found that over a considerable region of the North Atlantic there was a rise in temperature in the ocean waters and in the whole of the troposphere. In the equatorial zone of both hemispheres the surface layer of water and the adjacent layer (1 km) of air were colder, but the subsurface layer of water and the layer of the troposphere above the surface layer of air were warmer. Author

N73-25322 National Lending Library for Science and Technology, Boston Spa (England).
THE HEIGHT OF THE TROPOPAUSE AS A FORECASTING PARAMETER OF ONE MONTH FORECASTS
[1973] 11 p refs Transl. into ENGLISH from Hivat. Kiad. (Budapest), v. 35, 1970 p 109-116
(NLL-M-22839-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A macrosynoptic tropopause formula and its suitability for long range forecasts is discussed. The formula is used for temperature changes cooling down, warming up, and precipitation. Experimental results show the formula cannot be used in: (1) February, March, August, or September, (2) foggy weather (winter), (3) frequent 10 km tropopauses (summer), (4) long lasting anticyclones, and (5) extremely large pressure falls. E.H.W.

N73-25323 National Lending Library for Science and Technology, Boston Spa (England).
EVOLUTION OF THE TEMPERATURE ANOMALY IN A LAYER OF WATER OF THE ATLANTIC OCEAN FROM 1969 TO 1970 IN A CROSS SECTION ALONG 30 DEG W
A. L. Kac and K. O. Veljaots 26 Sep. 1972 9 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), 1971 p 146-153
(NLL-M-22849-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect of the observed temperature anomaly in the Atlantic

Ocean along the 30 deg W meridian is analyzed and interpreted in terms of phenomena contributing to instances of deterioration in general atmospheric circulation. Observations were made exactly one year apart in 1969 and 1970, and the conclusions are presented in tabular form. J.M.M.

N73-25324 Maryland Univ., College Park.
OBSERVATIONS OF INTERCHANGE BETWEEN ACCELERATION AND THERMALIZATION PROCESSES IN AURORAL ELECTRONS Ph.D. Thesis
Morris Bernard Pongratz 1972 275 p
Avail: Univ. Microfilms Order No. 72-29416

The results of high time resolution measurements of energetic electrons in an auroral break-up are presented. Electrons with energies from 500 eV to over 100 keV and pitch angles from 0 deg to 150 deg were detected with two detectors onboard sounding rocket 18:63 UE. Complete energy spectra were taken every 0.1 seconds. The procedure for cleaning and activating the BeCu dynodes of a small, rugged, high-gain electron multiplier is described. A theoretical study of the energy-angular response of a spherical plate electrostatic analyzer is compared to experimental results. An energy-spectrum unfolding technique which does not require the assumption of a histogram-type energy spectrum is presented. A method of determining sounding rocket orientation from the output of a single magnetometer is also described. Dissert. Abstr.

N73-25325 Stanford Univ., Calif.
GEOMAGNETIC SECULAR VARIATION DURING THE PAST 30000 YEARS, AS RECORDED IN SEDIMENTS Ph.D. Thesis
Charles Randall Denham 1972 75 p
Avail: Univ. Microfilms Order No. 72-30621

An paleomagnetic study of sediments from Mono Lake, California, shows that the geomagnetic field was normally polarized 13,000 to 30,000 years ago, and that if a reversal occurred during that time, it could not have lasted more than 1700 years. About 24,000 years ago, the local field underwent a distinct counter-clockwise looping of direction, lasting 1100 years, which may have been caused by eastward drift of the non-dipole field in California. In studies of sediments from California, England, and the Aegean Sea, the paleomagnetic field directions and their spectral analysis show that if the dipole axis was wobbling during the past 30,000 years, its path was not that of simple precession about the geographic axis. Furthermore, during this time, counter-clockwise field motion was guite common, in contrast to its minor occurrence in the geomagnetic field today. Dissert. Abstr.

N73-25326 Colorado State Univ., Fort Collins.
THE GLOBAL DISTRIBUTION OF TOTAL OZONE AS DETERMINED BY THE NIMBUS 3 SATELLITE INFRARED INTERFEROMETER SPECTROMETER Ph.D. Thesis
James Edward Lovill 1972 84 p
Avail: Univ. Microfilms Order No. 72-31332

A strong correlation was found between the meridional gradient of total ozone and the wind velocity in jet stream systems. A procedure evolved which will allow the computation of the wind velocity at 250 mb. A study of the total ozone distribution over two tropical storms indicated that each disturbance was associated with a distinct ozone minimum. A comparison of time-longitude stratospheric radiance values at 60 degrees with values of the total ozone indicated that low (high) radiance values corresponded very closely with the low (high) ozone variations. The average latitudinal distribution of ozone is described for the first time, both temporally and spatially, during the autumn and winter in the Southern Hemisphere. The lowest mean total ozone value for the globe is observed 6 degrees S. Maps are presented that describe the distribution of total ozone for the entire period (April to July 1969) for the Northern and Southern Hemispheres. Dissert. Abstr.

N73-25327 New Mexico Univ., Los Alamos.
POLARIZATION OF INFRARED WAVES DUE TO PROPAGATION THROUGH THE ATMOSPHERE Ph.D. Thesis
Joseph Philip Castillo 1972 232 p
Avail: Univ. Microfilms Order No. 72-30751

An investigation is presented of the polarization of infrared waves due to propagation through the atmosphere. Cumulus cloud and haze M particle size distributions are considered for various optical depths at wavelengths of 4.0 and 10.0 micron. Results at these wavelengths are compared to results at a wavelength of 0.5 micron for the same physical atmosphere. Initially the radiative transfer integral equations are derived which include the Stokes polarization vector. From these integral equations a Monte Carlo simulation technique is used to simulate photon histories through the atmosphere. The effects of multiple scattering on the polarization state of the scattered intensity is included. A diffuse scattering ground which causes complete depolarization of the incident intensity is included in the simulation model. Dissert. Abstr.

N73-25328 Kansas Univ., Lawrence.
SHAPE OF THE EARTH MAGNETOSPHERE Ph.D. Thesis
Joon Yoll Choe 1972 201 p
Avail: Univ. Microfilms Order No. 72-32870

The shape of the magnetopause for various orientations of the solar wind stream with respect to the earth dipole axis has been calculated by a self-consistent method, in which the surface equation and the magnetic field integration form one iteration. The surface is determined by the magnetohydrodynamic pressure balance equation and the magnetic field due to the surface currents on the boundary is obtained from Biot-Savare's law. The solar wind is assumed to have no random motions and to be free from magnetic fields, and the solar wind particles are assumed to undergo specular reflections from the boundary. The procedure used is in many ways similar to the method of Mead and Beard (for perpendicular incidence) and Olson (for oblique incidence). Improvements are, however, achieved by using finer grid near the neutral point and by including an analytic singularity calculation in the magnetic field calculation. The result shows very excellent convergence in the surface equation and improved satisfaction of the boundary conditions. Dissert. Abstr.

N73-25329 Minnesota Univ., Minneapolis.
THE ELECTRON ECHO EXPERIMENT: A COMPARISON BETWEEN THE OBSERVED AND PREDICTED TRAJECTORIES OF ELECTRONS ARTIFICIALLY INJECTED INTO THE MAGNETOSPHERE Ph.D. Thesis
Richard William McEntire 1972 266 p
Avail: Univ. Microfilms Order No. 72-32310

On August 13, 1970, a sounding rocket launched from Wallops Island, Virginia, was used to successfully inject a controlled beam of energetic electrons into the trapping region of the earth's magnetosphere. The Aerobee 350 rocket carried a high voltage electron gun, electron detectors, receivers to measure the electric field of waves generated by the experiment, and other apparatus to a peak altitude of 350 km. More than 3000 16 msec long, 70 ma pulses of 35 to 43 keV electrons were injected into the magnetosphere during the 10 minutes flight, with pitch angles within 25 deg of the local 90 deg mirror angle. The electrons, trapped in the geomagnetic field, bounced between the mirror point near the rocket and the southern conjugate point (-66 deg latitude, -82 deg longitude) while drifting eastward across field lines on a drift shell of constant McIlwain L parameter (2.58) under the gradient and curvature forces. Dissert. Abstr.

N73-25330 Colorado State Univ., Fort Collins.
ATMOSPHERIC NEUTRAL-ELECTRICAL INTERACTION (NEW PHENOMENOLOGICAL CONCEPTS BASED ON OBSERVATION) Ph.D. Thesis
Willis Lee Webb 1972 65 p
Avail. Univ. Microfilms Order No. 72-31354

The concept that the earth's electrical structure is a unified system which is controlled primarily by neutral atmosphere dynamics of the stratospheric thermal tides is presented. Comprehensive models of the conductivity structure of the atmosphere were developed. The primary electrical circuit of the earth's environment is identified. A physical process for the motivation of dynamic currents in the earth atmosphere is explained. Dissert. Abstr.

N73-25331 Saskatchewan Univ., Saskatoon.
THE MEASUREMENT AND INTERPRETATION OF O2(1 DELTA g) CONCENTRATIONS IN THE ATMOSPHERE Ph.D.

Thesis
Hugh Charles Wood 1972 251 p
Avail: Univ. Microfilms Order No. 72-31375

The O2(1 Delta g) concentrations in the atmosphere at sunrise and sunset were derived from two rocket measurements of the height profile of the 1.27 micro-meter emission. The rocket flights, from Fort Churchill during March 1969 into successive twilights, measured the emission from the infrared atmospheric system of oxygen to an altitude of 110 km with interference filter photometers using thermoelectrically cooled detectors. The derived O2(1 Delta g) concentration height profiles at sunrise and sunset have confirmed the existence of a two layer surface for the concentration of O2(1 Delta g) molecules in the atmosphere while the atmosphere is illuminated by solar radiation. Dissert. Abstr.

N73-25332 California Univ., Riverside.
STUDY OF THE SPATIAL DISTRIBUTIONS OF OFF-EQUATORIAL PROTONS AT L EQUALS 1.4-1.8 Ph.D. Thesis
Lee Mickelson 1972 66 p
Avail: Univ. Microfilms Order No. 72-31495

Multiple Coulomb scattering of inner belt protons is shown to be negligible as a mechanism for redistribution. Random electrostatic waves with a correlation time on the order of the drift period of the protons are shown to be an effective radial diffusion mechanism for off-equatorial protons. The equatorial power spectrum for waves of magnitude 5 mv/m and correlation time of 30 seconds is shown to be 0.35 (mv/m)squared/Hz, within the limits of the experimentally derived power spectrum. Dissert. Abstr.

N73-25333 Colorado State Univ., Fort Collins.
EARTH DYNAMIC FILTERING FOR EARTHQUAKE PREDICTION AND LOVE NUMBER DETERMINATION Ph.D. Thesis
Paul Frederick McClure 1972 163 p
Avail: Univ. Microfilms Order No. 72-31333

A discrete time extended Kalman filtering algorithm was developed for processing geodetic data. The method includes differential equations describing the rotational motion of a deformable earth as part of the model of the system that generates the observations. By including the earth dynamical relationships it is possible to determine the coordinates of the rotation pole as dynamical variables rather than as fixed parameters and to obtain an estimate for the position of the secular pole. Range observations are simulated with a 2 cm noise level between a geodetic satellite and a global network of ground stations. By responding to changes in the position of the secular pole, the method provides a new means for testing the hypothesis that major earthquakes correspond to detectable breaks in the path of the rotation pole and that the pole path may shift slightly prior to an earthquake as strain accumulates within large sections of the crust. Dissert. Abstr.

N73-25334*# Earth Satellite Corp., Washington, D.C.
FACILITATING THE EXPLOITATION OF ERTS-1 IMAGERY UTILIZING SNOW ENHANCEMENT TECHNIQUES Progress Report, 1 Sep. 1972 - 30 Apr. 1973
Frank J. Wobber, Principal Investigator, Kenneth R. Martin, and Roger V. Amato 24 May 1973 64 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21744)
(E73-10594; NASA-CR-131910) Avail: NTIS HC $5.25 CSCL 05B

The author has identified the following significant results. Snow cover in combination with low angle solar illumination has been found to provide increased tonal contrast of surface feature and is useful in the detection of bedrock fractures. Identical fracture systems were not as readily detectable in the fall due to the lack of a contrasting surface medium (snow) and a relatively high sun angle. Low angle solar illumination emphasizes topographic expressions not as apparent on imagery acquired with a higher sun angle. A strong correlation exists between the major fracture-lineament directions interpreted from multi-sensor imagery (including snow-free and snow cover ERTS) and the strike of bedrock joints recorded in the field indicating the structural origin of interpreted fracture-lineaments. A fracture-annotated ERTS-1 photo base map (1:250,000 scale) is being prepared for western Massachusetts. The map will document the utilization of ERTS-1 imagery for geological analysis in comparative snow-free and snow-covered terrain.

N73-25335*# Mississippi State Univ., State College. Inst. for Environmental Studies.
APPLICATION OF ERTS-A DATA TO AGRICULTURAL PRACTICES IN THE MISSISSIPPI DELTA REGION Progress Report
C. W. Bouchillon, Principal Investigator 21 Jun. 1973 8 p ERTS
(Contract NAS5-21881)
(E73-10597; NASA-CR-132175; PR-3) Avail: NTIS HC $3.00 CSCL 02D

There are no author-identified significant results in this report.

N73-25336*# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
SEDIMENT PATTERN CORRELATION WITH INFLOW AND TIDAL ACTION Progress Report
Warren E. Grabau, Principal Investigator 6 Jun. 1973 5 p ERTS
(NASA Order S-70259-AG)
(E73-10623; NASA-CR-132034) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. At the time the two scenes of the Chesapeake Bay Study Area were taken, ground truth data were taken at a number of stations within each of the test areas. Where local conditions permitted, either all or a part of the following parameters were measured: water temperature, spectral transmittance, conductivity, turbidity, dissolved oxygen, current velocity, and pH. In addition, a sample of water was taken at each location and the concentration of suspended material in each sample was determined. In the analysis the relationship of each measured parameter and the corresponding radiance values (reflectance spectrum) detected by the ERTS-1 were evaluated. Thus far, the analysis has shown a good correlation with concentrations of suspended material contained in the water.

N73-25337*# Maryland Geological Survey, Baltimore.
DIFFERENTIATION OF SERPENTINITIC FROM NONSERPENTINITIC ULTRAMAFIC ROCKS IN ERTS-1 MSS IMAGERY
William Crowley and Kenneth N. Weaver, Principal Investigator 27 Jun. 1973 2 p ERTS
(Contract NAS5-21848)
(E73-10632; NASA-CR-132198) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-25338*# Bendix Corp., Ann Arbor, Mich.
DETERMINE UTILITY OF ERTS-1 TO DETECT AND MONITOR AREA STRIP MINING AND RECLAMATION Interim Report, Nov. 1972 - Apr. 1973
Phillip E. Chase, Principal Investigator and Larry Reed May 1973 48 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21762)
(E73-10641; NASA-CR-132100) Avail: NTIS $4.50 CSCL 08I

There are no author-identified significant results in this report.

N73-25339*# Spectral Africa (Pty) Ltd., Randfontein (Republic of South Africa).
GROWTH AND DECLINE OF VEGETATION ON MINE DUMPS Progress Report, Feb. - Apr. 1973
B. P. Gilbertson, Principal Investigator May 1973 20 p ref Sponsored by NASA ERTS
(E73-10642; NASA-CR-132101; PR-2; Rept-73/11) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-25340*# Texas A&M Univ., College Station. Remote Sensing Center.
MONITORING THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION Progress Report, 28 Mar. - 27 May 1973
J. W. Rouse, Jr., Principal Investigator 27 May 1973 15 p ERTS
(Contract NAS5-21857)
(E73-10643; NASA-CR-132979; PR-3) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Continued evaluation of autumnal phase and early vernal phase data indicate that the quality of ERTS-1 imagery over the Great Plains Corridor test sites are adequate to show relatively small temporal changes in the condition and quantity of vegetation at the several test sites. Vegetation changes measured from August through April are observable in reflectance changes recorded by ERTS-1. Vegetation changes due to grazing treatment and environmental conditions at the test sites are being monitored with ground data and ERTS-1 data, and appear adequate to complete all phases of the Great Plains Corridor investigation. NASA high flight aerial photography proved to be an indispensable tool for locating the Great Plains Corridor test sites on the computer derived grey maps of ERTS-1 digital data.

N73-25341*# Itek Corp., Lexington, Mass. Optical Systems Div.
AUTOMATED THEMATIC MAPPING AND CHANGE DETECTION OF ERTS-A IMAGES Progress Report, 31 Mar. - 31 May 1973
Nicholas Gramenopoulos, Principal Investigator Jun. 1973 7 p ERTS
(Contract NAS5-21766)
(E73-10644; NASA-CR-132103) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-25342*# Eason Oil Co., Oklahoma City, Okla.
AN EVALUATION OF THE SUITABILITY OF ERTS DATA FOR THE PURPOSES OF PETROLEUM EXPLORATION Interim Report, Dec. 1972 - May 1973
Robert J. Collins, Principal Investigator, F. P. McCown, L. P. Stonis, and Gerald Petzel Jun. 1973 18 p ERTS
(Contract NAS5-21735)
(E73-10646; NASA-CR-132980) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. ERTS-1 imagery seems to be good to excellent for reconnaissance level investigations of large sedimentary basins such as the Anadarko Basin. Many lithologic boundaries, and geomorphic features, and linear features inferred to be indicative of geologic structure are visible in the imagery. This imagery in conjunction with high altitude photography seems to be useful as a tool for intermediate level geologic exploration. Several types of crudely circular anomalous features, such as geomorphic/structural anomalies, hazy areas and tonal anomalies, are identifiable in the imagery. There seems to be a strong correlation between the geomorphic/structural and hazy anomalies and known structurally controlled oil and gas fields. The features recognizable on ERTS-1 imagery and their ease of recognition vary from area to area even in imagery acquired at the same time under essentially uniform atmospheric conditions. Repeated coverage is exceedingly valuable in geologic applications. One time complete coverage even for the various seasons does not reveal all the features that ERTS-1 can reveal.

N73-25343*# TRW Systems Group, Redondo Beach, Calif.
ERTS IMAGE DATA COMPRESSION TECHNIQUE EVALUATION Monthly Progress Report, period ending 1 Mar. 1973
Donald J. Spencer, Principal Investigator 9 Mar. 1973 1 p ERTS
(Contract NAS5-21746)
(E73-10647; NASA-CR-132238; TRW-7132.1-09) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-25344*# Geological Survey, Washington, D.C.
GEOLOGIC MAPPING AND MINERAL RESOURCE INVENTORY BY ERTS-1 SATELLITE DATA IN SOUTH AMERICA Progress Report, 15 Jan. - 30 Apr. 1973
William D. Carter, Principal Investigator 1 May 1973 6 p refs Sponsored by NASA ERTS
(E73-10648; NASA-CR-132239) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. ERTS-1 data clearly provide significant contribution of new information on the remote areas of South America. Salar deposits have been measured and compared with those shown on World Navigation Charts; remarkable differences have been found in shape, size, number, and distribution. Repetitive coverage should enable us to develop an index of seasonal and annual environmental trends that can be compared with those of the Northern Hemisphere. New lineations, many of which are probably faults, have been found in Venezuela, Bolivia, and northern Argentina. Circular features, some of volcanic origin, have been recognized that are not shown on existing maps. The courses of several rivers have been revised and our Venezuelan counterparts report that a major new river has been recognized and charted. Large mining operations, such as the open pit copper mine of Chuquicamata in northern Chile, are recognizable and can be studied in their regional context.

N73-25345*# Geological Survey, Menlo Park, Calif.
STUDIES OF THE INNER SHELF AND COASTAL SEDIMENTATION ENVIRONMENT OF THE BEAUFORT SEA FROM ERTS-1 Progress Report, 1 Mar. - 1 May 1973
Erk Reimnitz, Principal Investigator and Peter W. Barnes 31 Mar. 1973 6 p refs ERTS
(NASA Order S-70243-AG)
(E73-10649; NASA-CR-132240) Avail: NTIS HC $3.00 CSCL 08J

The author has identified the following significant results. The particulate transport processes involved in the movement of surficial waters were examined using secchi disc readings, light attenuation coefficients, and particulate weights from filtration. Observations gathered during the summers of 1971 and 1972 indicate a remarkable difference in particulate matter and turbidity between the two years. ERTS-1 imagery during August 1972 showed turbid water along the northern Alaska coast. The uniformity of distribution of the turbid water and the fact that the river discharge is low at this period suggest that the turbidity is related to causes other than river effluent. Studies indicate that wave action is a more significant factor influencing particulate transport than believed heretofore. The boundary between the essentially immobile shorefast ice and the moving pack ice has been plotted from several ERTS-1 images and found to occur fairly consistently along the 20 meter contour. Considering the vast difference in the amount of ice movement shoreward and seaward of this boundary, ice-bottom action should also be different on either side of this boundary and for that matter at the shear zone that develops along the boundary.

N73-25346*# Geological Survey, Washington, D.C.
LAND USE MAPPING AND MODELLING FOR THE PHOENIX QUADRANGLE Progress Report, 1 Mar. - 30 Apr. 1973
John L. Place, Principal Investigator 1 May 1973 7 p ERTS
(NASA Order S-70243-AG)
(E73-10650; NASA-CR-132241) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. Comparison of 9 x 9 MSS band images and color composites made from bands 4, 5, and 6 showing vegetated areas near Phoenix during the summer, fall, and winter seasons aided in definitely establishing that certain land areas were being used as agricultural land and not as rangeland. Agricultural land, which appeared to be fallow, idle, or not irrigated, often became more readily identifiable as agricultural land when comparing different images of identical land areas which have been affected by seasonal vegetation changes. Experimentation with the Bausch and Lomb Zoom Transferscope using MSS images of identical areas in the same spectral band from different time periods,

with a quick flip method of alternately viewing the frame areas, enabled rapid detection of a major land use change from agricultural to urban use on the northwest fringe of the metropolitan Phoenix area. The best results in this case were obtained when comparing MSS band 5 images. Examination of MSS transparencies and color composites allowed further updating of a map of land use change in the Phoenix Quadrangle.

N73-25347*# Geological Survey, Washington, D.C.
THE CARTOGRAPHIC APPLICATION OF ERTS/RBV IMAGERY IN POLAR REGIONS Progress Report, 1 Mar. - 30 Apr. 1973
William R. MacDonald, Principal Investigator 1 May 1973 26 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG-2)
(E73-10651; NASA-CR-132242) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. Experiments have demonstrated the feasibility of revising coastlines on maps of Antarctica, detected gross changes in the northern limits of the three largest ice shelves in the world, and led to the discovery of uncharted mountain ranges. A strip photomosaic compiled at a scale of 1:1,000,000 along the Victoria Land Coast between Cape Adare and Harboard Glacier shows obvious changes in size, shape, and position of such features as glaciers, ice tongues, ice shelves, and fast ice. Similar changes to features in the Thwaites Glacier Tongue area were also discovered. Comparison of existing maps and photographs with ERTS-1 imagery over portions of the Ross and Filchner-Ronne Ice Shelves reveals that their northern limits have advanced about 6 and 15 km respectively in 7 years. Imagery also revealed new and unmapped geographical features, of which some are mountains, in the area of the recently published Australian 1:1,000,000 IMW sheet SS 40-42 and USGS IMW sheet ST 57-60 which is presently in final stages of compilation. Comparison of one ERTS-1 scene with a recently published USGS map disclosed a unique change in the Erebus Glacier Tongue. Indications are that its present position is about the same as it was in 1910.

N73-25348*# Geological Survey, Nashville, Tenn.
INVESTIGATION OF BASIN CHARACTERISTICS EXTRACTED FROM ERTS DATA FOR IMPROVING REGRESSION ESTIMATES OF STREAMFLOW Progress Report, 1 Sep. - 31 Oct. 1972
Este F. Hollyday, Principal Investigator 1 Nov. 1972 3 p ERTS
(NASA Order S-70243-AG-2)
(E73-10652; NASA-CR-132243) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-25349*# Mississippi State Univ., State College. Dept. of Electrical Engineering.
STUDY OF THE APPLICATION OF REMOTE SENSING DATA TO LAND USE PLANNING ON THE MISSISSIPPI GULF COAST Progress Report
Frank Ingles, Principal Investigator 8 Jun. 1973 6 p ERTS
(Contract NAS5-21817)
(E73-10653; NASA-CR-132244; PR-4) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-25350*# Maine Dept. of Transportation, Augusta.
TO DEVELOP A LAND USE: PEAK RUNOFF CLASSIFICATION SYSTEM FOR HIGHWAY ENGINEERING PURPOSES Interim Report, Jan. - Jun. 1973
Ernest G. Stoeckeler, Principal Investigator 1 Jun. 1973 5 p ERTS
(Contract NAS5-21724)
(E73-10654; NASA-CR-132245) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-25351*# Army Construction Engineering Research Lab., Champaign, Ill.
EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY Progress Report, 9 Dec. 1972 - 8 Jun. 1973
R. K. Jain, Principal Investigator 8 Jun. 1973 5 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70255-AG)
(E73-10655; NASA-CR-132246) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-25352*# Bureau de Recherches Geologiques et Minieres, Orleans (France).
CAPABILITY OF ERTS-1 IMAGERY TO INVESTIGATE GEOLOGICAL AND STRUCTURAL FEATURES IN A SEDIMENTARY BASIN (BASSIN PARISIEN, FRANCE)
Guy Weecksteen, Principal Investigator, C. Cavelier, J. Y. Scanvic, and A. Zizerman [1973] 2 p Sponsored by NASA ERTS
(E73-10656; NASA-CR-132247) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. The region covered by the MSS images has the benefit of complete geological mapping at scales of 1:80,000, 1:320,000, and 1:1,000,000. Comparison of imagery and exisiting geological maps, particularly the 1:1,000,000 scale, produces important information: (1) Good correspondence is seen between large units distinguished on the images and the concentric strata of the Jurassic, Cretaceous, and Paleocene on the map. (2) Comparison of MSS images with the hydrogeological map of the Parisian basin at 1:500,000 removes all ambiguity with regard to lighological variations. Among the many faults revealed, only three were considered: (1) the Metz; (2)Juranze; and (3) the double fault of the Marne. Imagery shows a conspicuous alignment of the Metz fault unknown until now and ending near Montereau against the group of north-south faults between Montargis and Bourbon l'Archambault. MSS images show that the Juranze fault divides beyond Brienne into two branches of equal importance. The northern one represents the known fault, the southern one was not known until now, but the convergence of the faults constitutes a tectonic trap. The double fault of the Marne is known for a total length of 50 km. ERTS-1 imagery suggest a prolongation toward the southeast which could bring its length to 110 km.

N73-25353*# Bureau de Recherches Geologiques et Minieres, Orleans (France).
STRUCTURAL GEOLOGY INVESTIGATION ON MASSIF CENTRAL AND PARISIAN BASIN (FRANCE)
Guy Weecksteen, Principal Investigator [1973] 2 p Sponsored by NASA ERTS
(E73-10657; NASA-CR-132248) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Band 5 gives the most information concerning the fracturing in the Massif Central and Parisian Basins. Band 6 and 7 show the fractures emphasized by forest boundaries and by the linear trace of water courses. The most remarkable information drawn from the preliminary investigation of two ERTS-1 images covering two different landscapes, a regular relief of shelving plateau bounded by cuestas having a sedimentary origin and a mountainous. region built in crystalline and volcanic rocks, is that the deep structural elements under a thick sedimentary cover can be translated on the surface by indirect criteria. MSS imagery has permitted the Metz fault to be extended towards the west and shows clearly, through land use on the Rhone Valley fluvial deposit, the continuation towards the east of the carboniferous basin of St. Etienne.

N73-25354*# National Marine Fisheries Service, Bay Saint Louis, Miss.
APPLICATION OF REMOTE SENSING FOR FISHERY

RESOURCE ASSESSMENT AND MONITORING Monthly Progress Report, 1 May - 8 Jun. 1973
William H. Stevenson, Principal Investigator 12 Jun. 1973 5 p EREP
(NASA Order T-8217-B)
(E73-10658; NASA-CR-132249; HPR-2) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-25355*# Arizona Univ., Tucson.
A STUDY TO EXPLORE THE USE OF ORBITAL REMOTE SENSING TO DETERMINE NATIVE ARID PLANT DISTRIBUTION Progress Report, 16 Apr. - 16 Jun. 1973
William G. McGinnies, Principal Investigator 16 Jun. 1973 4 p ERTS
(Contract NAS5-21812)
(E73-10659; NASA-CR-132168) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-25356*# Cornell Univ., Ithaca, N.Y.
PHENOLOGY SATELLITE EXPERIMENT Progress Report, 8 Feb. - 8 Apr. 1973
Bernard E. Dethier, Principal Investigator 8 Apr. 1973 2 p refs ERTS
(Contract NAS5-21781)
(E73-10660; NASA-CR-132169) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-25357*# Tennessee Univ., Knoxville. Dept. of Geography.
GEOGRAPHIC ANALYSIS OF LANDSCAPE CHANGE FROM ERTS-1 IMAGERY Progress Report
John B. Rehder, Principal Investigator Jun. 1973 26 p ref Original contains imagery. Orignal photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21726)
(E73-10661; NASA-CR-132170) Avail: NTIS HC $3.50 CSCL 08F

There are no author-identified significant results in this report.

N73-25358*# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
MOVEMENT OF SUSPENDED PARTICLE AND SOLUTE CONCENTRATIONS WITH INFLOW AND TIDAL ACTION Interim Report, Aug. 1972 - Feb. 1973
A. N. Williamson Feb. 1973 19 p ref ERTS
(NASA Order S-70259-AG)
(E73-10662; NASA-CR-132171) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N73-25359*# Wyoming Univ., Laramie. Remote Sensing Lab.
ANALYSIS OF PHOTO LINEAR ELEMENTS, LARAMIE MOUNTAINS, WYOMING
Donald L. Blackstone, Jr. 1 Jun. 1973 16 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21779)
(E73-10663; NASA-CR-132172; ERTS-1-S73-3) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Photo linear features in the Precambrian rocks of the Laramie Mountains are delineated, and the azimuths plotted on rose diagrams. Three strike directions are dominant, two of which are in the northeast quadrant. Laramide folds in the Laramie basin to the west of the mountains appear to have the same trend, and apparently have been controlled by response of the basement along fractures such as have been measured from the imagery.

N73-25360*# Alaska Univ., Fairbanks.
GLACIOLOGICAL AND VOLCANOLOGICAL STUDIES IN THE WRANGELL MOUNTAINS, ALASKA Bimonthly Progress Report
Carl S. Benson, Principal Investigator 31 May 1973 5 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21833)
(E73-10665; NASA-CR-132176; BMPR-5) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-25361*# Arizona Univ., Tucson. Dept. of Watershed Management.
USE OF EARTH RESOURCES TECHNOLOGICAL SATELLITE (ERTS) DATA IN A NATURAL RESOURCE INVENTORY Progress Report, 1 Apr. - 31 May 1973
Ernest B. Fish, Principal Investigator 31 May 1973 2 p ERTS
(Contract NAS5-21820)
(E73-10666; NASA-CR-132177) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-25362*# Maine Dept. of Transportation, Augusta.
MAP THE DISTRIBUTION OF GLACIOFLUVIAL DEPOSITS AND ASSOCIATED GLACIAL LANDFORMS Interim Report, Nov. 1972 - May 1973
Raymond G. Woodman, Principal Investigator May 1973 8 p ERTS
(Contract NAS5-21747)
(E73-10667; NASA-CR-132178) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N73-25363*# Natural Resources Management Corp., Berkeley, Calif.
INVESTIGATION OF THE DETECTION AND MONITORING OF FOREST INSECT INFESTATION IN THE SIERRA NEVADA MOUNTAINS OF CALIFORNIA Progress Report, 1 Dec. 1972 - 31 May 1973
Ralph C. Hall, Principal Investigator 31 May 1973 10 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21770)
(E73-10668; NASA-CR-132179) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. Results of analysis of ERTS-1 color composites made by NASA from MSS bands 4, 5, and 7, frame #1055-18055 at a scale of 1:1,000,000 indicate that forests damaged by insects can be delineated and mapped from areas with no damage; and at this same scale other details detected include timbered and nontimbered areas, pasture and agricultural land, deserts, lakes, mountain meadows, riparian vegetation, rock domes, old burned areas, and major stream courses. Enlargements from the above to a scale of 1:80,000 have improved detectibility to the point that three degrees of timber mortality can be identified and mapped.

N73-25364*# Earth Satellite Corp., Berkeley, Calif.
A SCHEME FOR THE UNIFORM MAPPING AND MONITORING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES USING ERTS-1 IMAGERY Progress Report, 1 Mar. - 30 Apr. 1973
Charles E. Poulton, Principal Investigator and Robin I. Welch 25 May 1973 7 p ERTS
(Contract NAS5-21830)
(E73-10669; NASA-CR-132180; PR-4) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-25365*# Purdue Univ., Lafayette, Ind.
EVALUATION AND COMPARISON OF ERTS MEASUREMENTS OF MAJOR CROPS AND SOIL ASSOCIATIONS FOR SELECTED SITES IN THE CENTRAL UNITED STATES Bimonthly Progress Report, 1 Mar. - 30 Apr. 1973
Marion F. Baumgardner, Principal Investigator 30 Apr. 1973 8 p refs ERTS
(Contract NAS5-21785)
(E73-10670; NASA-CR-132181) Avail: NTIS HC $3.00 CSCL 02D

The author has identified the following significant results. The most significant result was the use of the temporal overlay technique where the computer was used to overlay ERTS-1 data from three different dates (9 Oct., 14 Nov., 2 Dec.). The registration of MSS digital data from different dates was estimated to be accurate within one half resolution element. The temporal overlay capability provides a significant advance in machine-processing of MSS data. It is no longer essential to go through the tedious exercise of locating ground observation sites on the digital data from each ERTS-1 overpass. Once the address of a ground observation site has been located on a digital tape from any ERTS-1 overpass, the overlay technique can be used to locate the same address on a digital tape of MSS data from any other ERTS-1 pass over the same area. The temporal overlay technique also adds a valuable dimension for identifying and mapping changes in vegetation, water, and other dynamic surface features.

N73-25366*# Battelle Columbus Labs., Ohio.
CALIBRATION AND EVALUATION OF SKYLAB ALTIMETRY FOR GEODETIC DETERMINATION OF THE GEOID Progress Report, 1-31 May 1973
A. George Mourad, Principal Investigator 13 Jun. 1973 3 p EREP
(Contract NAS9-13276)
(E73-10671; NASA-CR-132182; PR-3) Avail: NTIS HC $3.00 CSCL 08E

There are no author-identified significant results in this report.

N73-25367*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
UTILIZATION OF ERTS-1 DATA IN THE HOUSTON AREA
R. Bryan Erb, Principal Investigator 12 Mar. 1973 2 p ERTS
(E73-10672; NASA-TM-X-69261) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Using clustering techniques, several large lakes in Texas have been accurately delineated in computer printout graymaps. It was also found that small bodies of water (one to two acres in size) could be detected by searching for small reflectance values in the infrared data. A graymap printout of a lake described a shore outline that was not consistent with available maps. Field examination revealed that the actual level of the lake was below that for which the map was drawn. The current lake configuration agrees in shape and relative size with the ERTS-1 data printout. Water turbidity causes reflectance changes which are detectable in ERTS-1 band 7 data. A comparison has been made of the Monterey Bay, California area using 1971 aerial color infrared photography and a 1972 ERTS-1 band 7 infrared image. This comparison revealed that some event has occurred to impound a significant amount of water in the area since the infrared photography was taken. Data values in the ERTS-1 infrared image exhibit detectable changes in brightness at inflow points, where high turbidity would be present. Researchers had not expected to detect water turbidity patterns in band 7 (800 to 1100 nanometers).

N73-25368*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DETECTION OF SMALL PONDS ON ERTS-1 IMAGERY
R. Bryan Erb, Principal Investigator 20 Mar. 1973 1 p ERTS
(E73-10673; NASA-TM-X-69262) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. It has been determined that ponds within forested areas as small as one hectare (2.5 acres are detectable from the ERTS-1 data. This finding was made from the analysis of scene #1037-16244 on 29 August 1972 over the Sam Houston National Forest in Walker County, Texas. These ponds were identified on the 9 inch B/W transparencies magnified seven times in areas of contrast ratios in a range of 1:1.2 to 1:2.0.

N73-25369*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DETECTION OF PRESCRIBED BURN ON NATIONAL FOREST
R. Bryan Erb, Principal Investigator [1973] 1 p ERTS
(E73-10674; NASA-TM-X-69263) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. The effects of a prescribed burn in the Sam Houston National Forest have been detected from ERTS-1 coverage of November 27, 1972. The burn was first identified on aircraft underflight photography of November 7, 1972. On color infrared aircraft photography it appeared as a green patch, indicating stressed vegetation, in an area of red coloration, indicating vigorous vegetation. It was later detected on the color composite of ERTS-1 bands 4, 5, and 7, as a black area in otherwise red vegetation. The fire, covering approximately 40 hectares (100 acres), was intentionally started to clear out heavy underbrush so that trees could be marked prior to harvesting. The significance of this observation is that a light burn of this type and its subsequent effects on vegetation could be detected on ERTS-1 imagery. Continued observation of this type of phenomenon under various conditions may provide a means of identifying such an occurrence without a prior knowledge of the event.

N73-25370*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN OBJECTIVE TECHNIQUE TO ESTIMATE PERCENTAGE OF AN ERTS-1 WATER BOUNDARY RESOLUTION ELEMENT COVERED BY WATER
R. Bryan Erb, Principal Investigator [1973] 1 p ERTS
(E73-10675; NASA-TM-X-69264) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. An objective technique was developed to measure the surface area of water bodies. Nineteen water bodies in the Houston and Galveston, Texas area were selected as a basis for the technique development. The actual surface area of each body was determined from rectified and enlarged NASA aircraft photography. A clustering algorithm was used to produce classification maps of the region from ERTS-1 data. Certain classes were identified as being 100% water. Other classes were identified as being mixtures of water with land or vegetation. The number of picture elements falling on each water body and its boundary were counted. A linear regression analysis was performed to relate the total number of picture elements and boundary elements counted to the actual surface area. The standard error of the estimate was 6.7 acres. The absolute error was not a function of the actual surface area of the water body.

N73-25371*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ANALYSIS OF USEFULNESS OF ERTS-1 MSS DATA IN DETECTING AND MEASURING COASTAL MARSHES
R. Bryan Erb, Principal Investigator [1973] 1 p ERTS
(E73-10676; NASA-TM-X-69265) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. The usefulness of ERTS-1 data in detecting and measuring coastal marshes has been analyzed. The data chosen for study was taken over the Houston Area Test Site on August 29, 1972. A study site was selected which contained marshes of varying size. Using a computerized clustering algorithm which groups areas of spectral homogeneity, it was possible to distinguish twenty-five classes or features. To determine the total acreage of the marshes, the pure picture elements were counted. Using a technique developed by the team, the boundary picture elements were also counted. Ground truth was provided from rectified, enlarged, and scaled high altitude aircraft photography acquired during the same time frame. Comparison of the ground truth coverage depicted by the aircraft photography to the clustering acreage displayed from the ERTS-1 data showed a percentage

of accuracy ranging from 89% to 99% for determining areal extent of coastal marshes.

N73-25372*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EDITING ERTS-1 DATA TO EXCLUDE LAND AIDS CLUSTER ANALYSIS OF WATER TARGETS
R. Bryan Erb, Principal Investigator [1973] 1 p ERTS
(E73-10677; NASA-TM-X-69266) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. It has been determined that an increase in the number of spectrally distinct coastal water types is achieved when data values over the adjacent land areas are excluded from the processing routine. This finding resulted from an automatic clustering analysis of ERTS-1 system corrected MSS scene 1002-18134 of 25 July 1972 over Monterey Bay, California. When the entire study area data set was submitted to the clustering only two distinct water classes were extracted. However, when the land area data points were removed from the data set and resubmitted to the clustering routine, four distinct groupings of water features were identified. Additionally, unlike the previous separation, the four types could be correlated to features observable in the associated ERTS-1 imagery. This exercise demonstrates that by proper selection of data submitted to the processing routine, based upon the specific application of study, additional information may be extracted from the ERTS-1 MSS data.

N73-25373*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDIES OF IMAGES OF SHORT-LIVED EVENTS USING ERTS DATA Progress Report, 1 Mar. - 30 Apr. 1973
William A. Deutschman, Principal Investigator 30 Apr. 1973 2 p ERTS
(Contract NAS5-21858)
(E73-10678; NASA-CR-132184) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. Of significance are the continued detection and analysis of such short-lived events as forest fires, oil spills, vegetation damage, volcanoes, storm ridges, and earthquakes.

N73-25374*# South Dakota State Univ., Brookings.
ERTS DATA USER NO. 119: EFFECTIVE USE OF ERTS MULTISENSOR DATA IN THE GREAT PLAINS. ERTS-1 MSS IMAGERY: A TOOL FOR IDENTIFYING SOIL ASSOCIATIONS Progress Report, period ending 31 May 1973
Victor I. Myers, Principal Investigator and Frederick C. Westin 31 May 1973 38 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21774)
(E73-10679; NASA-CR-132186) Avail: NTIS HC $4.00 CSCL 08M

The author has identified the following significant results. Soil association maps show the spatial relationships of land units developed in unique climatic, geologic, and topographic environments, and having characteristic slopes, soil depths, textures, available water capacities, permeabilities, and the like. ERTS-1 imagery was found to be a useful tool in the identification of soil associations since it provides a synoptic view of an 8 million acre scene, which is large enough so that the effect can be seen on soils of climate, topography, and geology. A regional view also allows soil associations to be observed over most, if not all, of their extent. ERTS-1 MSS imagery also provides four spectral bands taken every 18 days which give data on relief, hydrology, and vegetation, all of which bear on the delineation and interpretation of soil associations. Enlarged prints derived from the individual spectral bands and shown in gray tones were useful for identifying soil associations.

N73-25375*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
IDENTIFICATION AND MAPPING OF LAND USE CLASSES IN MARION COUNTY (INDIANAPOLIS), INDIANA BY MACHINE PROCESSING OF ERTS-1 MSS DATA
D. A. Landgrebe, Principal Investigator 18 May 1973 1 p ERTS
(Contract NAS5-21773)
(E73-10680; NASA-CR-132187) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-25376*# Earth Satellite Corp., Washington, D.C.
STUDY OF APPLICATION OF ERTS-A IMAGERY TO FRACTURE RELATED MINE SAFETY HAZARDS IN THE COAL MINING INDUSTRY Progress Report, 1 Mar. - 1 May 1973
Charles E. Wier, Frank J. Wobber, Principal Investigators, Orville R. Russell, and Roger V. Amato 9 May 1973 15 p Prepared for Ind. Geol. Surv., Bloomington ERTS
(Contract NAS5-21795)
(E73-10681; NASA-CR-132188) Avail: NTIS HC $3.00 CSCL 08I

The author has identified the following significant results. The 70mm black and white infrared photography acquired in March 1973 at an approximate scale of 1:115,000 permits the identification of areas of mine subsidence not readily evident on other films. This is largely due to the high contrast rendition of water and land by this film and the excessive surface moisture conditions prevalent in the area at the time of photography. Subsided areas consist of shallow depressions which have impounded water. Patterns with a regularity indicative of the room and pillar configuration used in subsurface coal mining are evident.

N73-25377*# Helsinki Univ. (Finland). Dept. of Geology.
MAJOR CRUSTAL FRACTURES IN THE BALTIC SHIELD Progress Report, Jul. 1972 - Apr. 1973
Heikki V. Tuominen, Principal Investigator 15 May 1973 32 p refs Sponsored by NASA ERTS
(E73-10682; NASA-CR-132189) Avail: NTIS HC $3.75 CSCL 08G

The author has identified the following significant results. Black and white prints and transparencies of images 1039-09315, 1039-09322, and 1040-09371 with all bands of MSS have been used for the analyses. Bands 4 and 5 reveal the major urban areas, agricultural and timbering areas, highways as well as airfields, and an open pit mine. Even the border between Norway and Finland is clearly visible. Lakes, rivers, and wet swamps were best discerned on IR bands 6 and 7. Block fields formed by frost action are best seen on bands 4 and 5. The ancient shoreline on image 1039-09322 is seen as a narrow block field on bands 4 and 5. The effects of the Quaternary ice sheet on the morphography can be seen quite well in the images. The peat bogs are best seen in band 5, but can also be traced in bands 6 and 7. Eskers, glaciofluvial deposits, and deltas are distinguishable in bands 4 and 5, but can be traced in places also in the IR bands. Fluvial deposits are seen in the image 1039-09322 in the valleys of the Tornio and Kemi Rivers. They are easily discerned in bands 4 and 5, evidently because of the cultivated fields and pasture lands. Bands 4, 5, and 6 of image 1039-09315 reveal parts of eskers and glaciofluvial deltas which are affected by eolian activity. It seems evident that ERTS-1 imagery will be a great help in mapping Quaternary features.

N73-25378*# Delaware Univ., Newark. Coll. of Marine Studies.
DYNAMICS OF PLANKTON POPULATIONS IN UPWELLING AREAS
Karl-Heinz Sekielda, Principal Investigator Oct. 1972 17 p ERTS
(Contract NAS5-21784)
(E73-10683; NASA-CR-132190) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-25379*# Alaska Univ., College. Geophysical Inst.
TECTONIC MAPPING IN ALASKA WITH ERTS-1 IMAGERY Interim Scientific Report
Larry Gedney, Principal Investigator and James VanWormer 25 May 1973 8 p Original contains imagery. Original

photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21833)
(E73-10685; NASA-CR-132192) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. A mosaic of ERTS-1 imagery for a portion of interior Alaska covering approximately 57,000 sq km has proved to be a valuable tool in identifying structural elements previously not recognized. Mapped faults are clearly recognizable and are found to be part of a larger system of faults and lineaments identified on the imagery. A previously unrecognized set of conjugate fractures imply regional compression in a NNW-SSE direction in agreement with known fault dislocations. Earthquakes have a marked tendency to occur at intersections of lineaments seen on the imagery.

N73-25380*# RAND Corp., Santa Monica, Calif.
APPLICABILITY OF ERTS FOR SURVEYING ANTARCTIC ICEBERG RESOURCES Progress Report, Feb. - Apr. 1973
John L. Hult, Principal Investigator and Neill C. Ostrander Apr. 1973 5 p ERTS
(Contract NAS5-21905)
(E73-10686; NASA-CR-132193) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. Recognition and interpretation of icebergs proves to be easy when they are locked in sea or fast ice. They stand out in relief, particularly well in band 7. Recognition of isolated icebergs is much more difficult. Size, shape, interaction with sea ice, and change over time must then be used to help in positive identification. There seems to be much less current and relative motion between icebergs and sea in much of the test sector than had been believed from available exploration information. However, most of this type of assessment must await the accumulation and analysis of the full season data.

N73-25381*# Honeywell, Inc., St. Paul, Minn. Systems and Research Div.
COMPUTERIZED INTERPRETATION OF ERTS DATA FOR FOREST MANAGEMENT
Leonard Kirvida 16 Apr. 1973 7 p Proposed for presentation at Conf. on Machine Process. of Remotely Sensed Data, Lafayette, Ind., 16-18 Oct. 1973 ERTS
(Contract NAS5-21866)
(E73-10687; NASA-CR-132194) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-25382*# North Carolina State Univ., Raleigh.
UTILIZATION OF ERTS-1 DATA IN NORTH CAROLINA Interim Report, Dec. 1972 - May 1973
C. W. Welby, Principal Investigator, J. O. Lammi, and R. J. Carson, III Jun. 1973 33 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21732)
(E73-10688; NASA-CR-132199) Avail: NTIS HC $3.75 CSCL 08B

The author has identified the following significant results. A wide range of potential uses for ERTS-1 imagery is described. Special emphasis has been placed upon studies in the Coastal Plain of North Carolina. Soil groups, water quality, and suspended sediment patterns in estuaries and offshore have been studied. A phytoplankton bloom has possibly been detected. The usefulness of the imagery in coastal landform surveys has been demonstrated as has its usefulness in monitoring developmental activity in the forests. Planners appear hesitant to use the imagery because of its small scale, but it is felt that as they become familiar with the imagery they will find it useful and time-saving for many purposes.

N73-25383*# Vermont Univ., Burlington.
ENVIRONMENTAL STUDY OF ERTS-A IMAGERY, LAKE CHAMPLAIN BASIN AND VERMONT Bimonthly Report, period ending 1 May 1973
A. O. Lind, Principal Investigator 1973 5 p ERTS
(Contract NAS5-21753)
(E73-10690; NASA-CR-132201) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-25384*# Aerospace Corp., Los Angeles, Calif. Space Physics Lab.
STUDY TO DEMONSTRATE THE FEASIBILITY OF AND DETERMINE THE OPTIMUM METHOD OF REMOTE HAZE MONITORING BY SATELLITE Interim Report, Oct. 1972 - Mar. 1973
Ernest H. Rogers, Principal Investigator May 1973 37 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21719)
(E73-10691; NASA-CR-132974) Avail: NTIS HC $3.00 CSCL 04B

The author has identified the following significant results. Ground truth data has been obtained in order to determine the amount of haze present at the time of ERTS-1 passes over the Los Angeles area. October 21, 1972 was the haziest day, that was essentially cloud free, to date. At the time of the next pass, November 8, 1972 this area was quite clear. Changes in terrain features are minimized because these were consecutive passes. Digital tapes of the ERTS-1 data from these two days are being analyzed to determine the effects of haze on the data, in order to determine the optimum method for monitoring haze from a satellite. Preliminary results indicate that a slight reduction in contrast and some distortion of spectral signatures are caused by heavy haze. This effect is thought to be sufficient to determine the presence of moderate haze without the benefit of ground truth data. It is significant to note that there is very little degradation of ERTS-1 data caused by a rather heavy haze. For many purposes the data obtained on a hazy day are just as useful as that obtained on a clear day.

N73-25385*# RAND Corp., Santa Monica, Calif.
APPLICABILITY OF ERTS FOR SURVEYING ANTARCTIC ICEBERG RESOURCES Progress Report, May - Jun. 1973
John L. Hult, Principal Investigator and Neill C. Ostrander Jun. 1973 5 p ERTS
(Contract NAS5-21095)
(E73-10692; NASA-CR-132981) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N73-25386*# Tennessee Univ., Knoxville. Dept. of Geography.
GEOGRAPHIC ANALYSIS OF LANDSCAPE CHANGE FROM ERTS-1 IMAGERY
John B. Rehder, Principal Investigator Jun. 1973 1 p ERTS
(Contract NAS5-21726)
(E73-10694; NASA-CR-132998) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Data from low altitude flights and ground truth observations confirm the existence of significant strip mining activity at the Cumberland Plateau, Tennessee Test Site. A map (1:120,000) depicting landscape changes associated with strip mining on the Cumberland Plateau has been completed. The map was prepared from NASA generated RB-57 imagery for April 1972 and ERTS imagery for October 1972. A second map shows the generalized forest cover for the state of Tennessee. The data were derived entirely from five ERTS-1 images and reduced to an original map scale of 1:2.4 million. The most significant discovery concerns the detection, identification, and mapping of plowed fields in northern Alabama, northern Georgia, and southeastern Tennessee. In an April ERTS observation, plowed ground and bare soil surfaces were easily detected and mapped from MSS band 5.

N73-25387*# Servicio Geologico de Bolivia, La Paz.
EARTH RESOURCES TECHNOLOGY SATELLITE DATA COLLECTION PROJECT ERTS BOLIVIA Progress Report,

Oct. 1972 - May 1973
Carlos E. Brockman, Principal Investigator May 1973 5 p
Sponsored by NASA ERTS
(E73-10695; NASA-CR-132999) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-25388*# Bureau of Indian Affairs, Washington, D.C.
TIMBER RESOURCE INFORMATION SYSTEM Progress Report, 1 Mar. - 30 Apr. 1973
Arthur M. Woll, Principal Investigator 29 May 1973 3 p ERTS
(NASA Order S-70243-AG-3)
(E73-10696; NASA-CR-133000) Avail: NTIS HC $3.00 CSCL 02F

The author has identified the following significant results. The investigators are convinced that high altitude photography when supported with ground measurements and existing surveys, contain all the resource data needed for overall land management planning. This overall planning would include land use classification, environmental impact statements, and similar documentation. First inspection of the RBV ERTS imagery on the Quinault Reservation shows that much of the cultural and resources detail can be identified. Of particular note, is the obvious contrast between recently harvested timber cutting blocks as opposed to those cut more than a year ago. The RBV color composite would have been of better definition if band 3 had been excluded.

N73-25389*# Wyoming Univ., Laramie. Dept. of Geology.
MULTIDISCIPLINARY STUDY OF WYOMING TEST SITES Monthly Progress Report
Ronald W. Marrs Jun. 1973 6 p refs EREP
(Contract NAS9-13298)
(E73-10697; NASA-CR-133001) Avail: NTIS HC $3.00

The author has identified the following significant results. A field photometer system has been developed which allows faster and easier measurement of object reflectances. Preliminary tests indicate that the new system will be slightly accurate than the previous filter wheel system, in addition to being easier to operate, more rugged, more compact, and less expensive.

N73-25390*# Stanford Univ., Calif. School of Earth Sciences.
STRUCTURAL AND LITHOGRAPHIC STUDY OF NORTHERN COAST RANGES AND SACRAMENTO VALLEY, CALIFORNIA Progress Report
Ernest I. Rich, Principal Investigator 1 Jul. 1973 8 p ERTS
(Contract NAS5-21775)
(E73-10698; NASA-CR-133010) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. The analysis of the ERTS data has disclosed three potentially important linear systems within the northern coast ranges and Sacramento Valley, California. A preliminary geomorphic analysis of the northern coast ranges discloses that the geomorphic characteristics of the area underlain by the Coastal system are much different from those associated with the Central system in the core of the Coast Ranges. Within the Coastal system, or Coastal belt, the drainage networks are moderately fine-textured and have moderately high density. The area associated with the Central system seems to be underlain by an heterogeneous assemblage of rock types which vary in their resistance to erosion. The boundary between the Coastal and Central geomorphic regions is poorly defined and, in a few places, the two regions can be separated only approximately.

N73-25391*# Iowa Engineering Experiment Station, Ames.
REMOTE SENSING IN IOWA AGRICULTURE Progress Report, period ending 30 Jun. 1973
John P. Mahlstede, Principal Investigator, R. E. Carlson, and G. W. Thomson 28 Jun. 1973 5 p ERTS
(Contract NAS5-21839)
(E73-10699; NASA-CR-133012) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N73-25392*# Texas Instruments, Inc., Dallas.
EVALUATION OF COMMERCIAL UTILITY OF ERTS-A IMAGERY IN STRUCTURAL RECONNAISSANCE FOR MINERALS AND PETROLEUM Progress Report, 1 May - 30 Jun. 1973
Donald F. Saunders, Principal Investigator 9 Jul. 1973 5 p ERTS
(Contract NAS5-21796)
(E73-10700; NASA-CR-133013) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. In areas 2 and 3 (Colorado and New Mexico - Texas) continuing correlations are observed between lineaments selected from the ERTS imagery and known fault and fracture zones. There continues to be a correlation between lineament intersectional areas and known mining areas. Initial contacts with mining and/or petroleum companies regarding the use of ERTS-1 imagery as an interpreted medium for guiding reconnaissance operations seems to indicate that the technology and economics will be commercially acceptable for initial investigatory investments.

N73-25393*# Utah Univ., Salt Lake City. Dept. of Geological and Geophysical Science.
FRACTURE TRENDS IDENTIFIED BY ERTS-1 IMAGERY IN UTAH AND NEVADA
M. L. Jensen, Principal Investigator, M. Smith, and R. J. Rogers 24 Jun. 1973 123 p ERTS
(Contract NAS5-21883)
(E73-10701; NASA-CR-133014) Avail: NTIS HC $8.25 CSCL 08E

The author has identified the following significant results. Structures clearly traceable through bed rock are considered most reliable. Continuity, however, is frequently traceable through ranges and across adjoining sedimentary basins where changes in drainage, erosion pattern, soil color, or vegetation suggest that the basin sediments are extremely sensitive to underlying structures. Many large and continuous trends, too smeared by erosion to be visible on the ground or from aircraft photos, become quite evident at the scale of the ERTS-1 images. The study was made with little regard for surface geology. The trends have been retraced to separate and unidirectional sets. These are now being related to surface geology, geophysical studies, volcanic and intrusive centers, and areas of mineralization.

N73-25394*# Science Applications, Inc., La Jolla, Calif.
DETERMINATION OF AEROSOL CONTENT IN THE ATMOSPHERE FROM ERTS-1 DATA Progress Report, 7 May 1972 - 6 Jul. 1973
M. Griggs, Principal Investigator 7 Jul. 1973 15 p ERTS
(Contract NAS5-21860)
(E73-10702; NASA-CR-133015; SAI-73-565-LJ; PR-5) Avail: NTIS HC $3.00 CSCL 04A

The author has identified the following significant results. Significant results have been obtained using the digital data from ERTS-1. A linear relationship, as predicted by theory, has been shown to exist between the MSS radiances over water surfaces and the aerosol content of the atmosphere measured with a ground-based Volz sun photometer. The relationship, based on seven data points, appears best for MSS 6. This relationship will enable the atmospheric aerosol content to be monitored on a global basis, once it has been verified with further measurements, and should provide the information with considerable cost-savings over a ground-based photometer network.

N73-25395*# Wyoming Univ., Laramie. Dept. of Geology.
ANALYSIS OF LINEAR PHOTO ELEMENTS, BIGHORN-PRYOR MOUNTAINS, MONTANA AND WYOMING Special Report
D. L. Blackstone, Jr. 10 Jun. 1973 15 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21799)
(E73-10704; NASA-CR-133017; ERTS-1-S73-3) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-25396*# TRW Systems Group, Redondo Beach, Calif.
EVALUATION OF DIGITAL CORRECTION TECHNIQUES FOR ERTS IMAGES Bimonthly Progress Report, May - Jun. 1973
John E. Taher, Principal Investigator Jun. 1973 3 p ERTS
(Contract NAS5-21814)
(E73-10705; NASA-CR-133018) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-25397*# Earth Satellite Corp., Berkeley, Calif.
PLAN FOR THE UNIFORM MAPPING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES FROM SKYLAB IMAGERY Monthly Progress Report
Charles E. Poulton, Principal Investigator 31 May 1973 3 p EREP
(Contract NAS9-13286)
(E73-10706; NASA-CR-133019) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-25398*# National Marine Fisheries Service, Bay Saint Louis, Miss. Fisheries Engineering Lab.
INVESTIGATION USING DATA FROM ERTS TO DEVELOP AND IMPLEMENT UTILIZATION OF LIVING MARINE RESOURCES Progress Report, 20 Jan. - 20 Jul. 1973
William H. Stevenson, Principal Investigator and Edward J. Pastula, Jr. Jul. 1973 18 p refs ERTS
(NASA Order S-70246-AG)
(E73-10707; NASA-CR-133020) Avail: NTIS HC $3.00 CSCL 08A

The author has identified the following significant results. The feasibility of utilizing ERTS-1 data in conjunction with aerial remote sensing and sea truth information to predict the distribution of menhaden in the Mississippi Sound during a specific time frame has been demonstrated by employing a number of uniquely designed empirical regression models. The construction of these models was made possible through innovative statistical routines specifically developed to meet the stated objectives.

N73-25399*# Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.
APPLICATION OF REMOTE SENSING IN THE STUDY OF VEGETATION AND SOILS IN IDAHO
E. W. Tisdale, Principal Investigator 3 Jul. 1973 1 p ERTS
(Contract NAS5-21850)
(E73-10708; NASA-CR-133011) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-25400*# Mitre Corp., McLean, Va.
INVESTIGATION OF ENVIRONMENTAL INDICES FROM THE EARTH RESOURCES TECHNOLOGY SATELLITES Bimonthly Progress Report
Edward A. Ward, Principal Investigator 5 Jul. 1973 26 p ERTS
(Contract NAS5-21482)
(E73-10709; NASA-CR-133031) Avail: NTIS HC $3.50 CSCL 06F

There are no author-identified significant results in this report.

N73-25401*# Kanner (Leo) Associates, Redwood City, Calif.
INVESTIGATION OF THE INTERACTIONS BETWEEN RADIO BRIGHTNESS AND SURFACE CONDITIONS OF OCEANS BASED ON COSMOS-243 DATA
A. Ye. Basharinov and A. M. Shutko Washington NASA Jun. 1973 23 p refs Transl. into ENGLISH of the publ. "Issledovaniye Vzaimosvyazi Kharakteristik Poly Teplovogo Radioizlucheniya s Sostoyaniyem Poverkhnosti Akvatoriy" Moscow, Acad. of Sci., 1971 29 p
(Contract NASw-2481)
(NASA-TT-F-14954) Avail: NTIS HC $3.25 CSCL 08C

Results are presented from experimental studies and model calculations of the characteristics of the field of thermal radiation of the surface of the aquatorium in the SHF band. The data include mean values of radiating capacity, degree of polarization, and space-time variations of radiation density. The measurements performed from a point on the shore at wavelengths of 0.8, 1.35, 1.6, 3.2 and 3.37 cm, from aircraft at 3 cm and from the Cosmos-243 satellite at 0.8, 1.35, 3.4 and 8.5 cm indicated the dependence of radiation characteristics on wave height. Observations from the shoreline and the aircraft corresponded to wind speeds of up to 5 - 7.5 m/sec, and from the satellite up to 15 - 20 m/sec. The experimental results agree with the model concept of the dependence of radiating capacity on surface unevenness, primarily at slipping observation angles, and the influence of the radiation of spindrift at wind speeds over 5 - 7.5 m/sec. The data produced indicate the possibility of estimating the height of the surface of an aquatorium from measurements of natural thermal radiation.
Author

N73-25402# National Research Council of Canada, Ottawa (Ontario).
MOTIONS WITHIN THE EARTH'S CORE
F. H. Busse 1973 31 p refs Transl. into ENGLISH from Z. Geophys. (W. Germany), V. 37, No. 2, 1971 p 153-177
(NRC-TT-1635) Avail: NTIS HC $3.75

Characteristics of thermal instability of the earth's core and of the flow caused by the precession of the earth are considered. In both cases the primary rotation-ally symmetric solution becomes unstable whenever relevant physical parameters exceed a certain value. The instability takes the form of a non-axis flow, the dynamics of which correspond to those of Rossby waves. A study of the nonlinear terms in the equations of motion shows that for a finite amplitude the waves generate a flow in azimuthal direction that does not vanish in the mean. In the case of precession, this flow is expressed as a change in the original differential rotation from which the energy is drawn owing to the instability. It is concluded that both mechanisms, the production of heat in the core and the precession, act as sources of ehergy for the earth's magnetic field. Author

N73-25403# National Ocean Survey, Rockville, Md.
TIDAL CURRENT TABLES, 1973: ATLANTIC COAST OF NORTH AMERICA
1972 200 p refs
Avail: National Ocean Survey and its agents HC $3.00

Daily tidal current measurements made for selected stations along the Atlantic coast of North America are presented in tabular form.
A.L.

N73-25404*# Sandia Labs., Albuquerque, N.Mex.
THERMORADIATION INACTIVATION OF NATURALLY OCCURRING ORGANISMS IN SOIL
Marcel C. Reynolds, Kermit F. Lindell, and Thomas J. David May 1973 14 p refs
(Contract NASA Order W-12853)
(NASA-CR-132197; SLA-73-0161) Avail: NTIS HC $3.00 CSCL 08M

Samples of soil collected from Kennedy Space Center near spacecraft assembly facilities were found to contain microorganisms very resistant to conventional sterilization techniques. The inactivation behavior of the naturally occurring spores in soil was investigated using dry heat and ionizing radiation, first separately, then in combination. Dry heat inactivation rates of spores were determined for 105 and 125 C. Radiation inactivation rates were determined for dose rates of 660 and 76 krad/hr at 25 C. Simultaneous combinations of heat and radiation were then investigated at 105, 110, 115, 120, and 125 C. Combined treatment was found to be highly synergistic requiring greatly reduced radiation doses to accomplish sterilization. Author

N73-25405# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SEMIEMPIRICAL CALCULATION OF gf VALUES: Sc II (3d PLUS 4s) SQUARED MINUS (3d PLUS 4s) 4p, A DETAILED EXAMPLE
Robert L. Kurucz 30 May 1973 66 p refs
(SAO-Special-Rept-351; Rept-303-089) Avail: NTIS HC $5.50

A program is used to produce LS transition arrays and

electrostatic and spin-orbit matrices. Transition integrals are evaluated with scaled Thomas-Fermi-Dirac wave functions. Eigenvectors are found through a least squares procedure that fits computed eigenvalues to observed energy levels, and then the eigenvectors are used to transform the LS transition array to the observed coupling scheme. The final computed gf values are compared to laboratory measurements. Author

N73-25406# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
IONOSPHERIC DISTURBANCES PRODUCED BY SEVERE THUNDERSTORMS
Kenneth Davies and John E. Jones Dec. 1972 53 p refs
(NOAA-PP-6) Avail: SOD HC $0.80 Domestic Postpaid or $0.55 GPO Bookstore

Radio observations near Oklahoma City during the spring of 1970 have shown ionospheric effects that occur within a radius of 200 km from severe thunderstorms having cloud tops above 12 km (40,000 ft). These effects frequently take the form of acoustic-gravity waves that appear to originate in the thunderstorm cells and propagate to F-region heights. The power in the waves usually has peaks at periods near 3.5 and 4.5 min, although periods between 7 and 10 min have been observed occasionally. Three-dimensional velocity vectors were calculated for several ionospheric disturbances; and by means of acoustic wave ray-tracing, particular groups of thunderstorm cells have been identified as their sources. For the 7- to 10-min waves, an apparent inconsistency between the period and the velocity gives evidence of neutral winds with speeds of at least 70 m/s in the F region. The power required to produce waves of the type observed is estimated to be about 50 MW, one-millionth of the power generated by a large storm. Author

N73-25407# Norwegian Defence Research Establishment, Kjeller.
DISTURBANCES IN THE HIGH LATITUDE, LOWER IONOSPHERE
Trygve Roeed Larsen Mar. 1973 100 p refs
(NDRE-62) Avail: NTIS HC $7.00

Ionospheric disturbances occurring in regions north of 60 deg invariant latitude at atmospheric altitudes below about 100 km have been studied using ground based, balloon, rocket, and satellite data observed during specific events. Results from full wave analysis using locally measured electron density profiles are compared with measured phase and amplitude at 12.3 kHz for the short path Aldra to Tromso during different types of ionospheric disturbances. Evidence for a stratosphere-mesosphere coupling has been found in the VLF data during a stratospheric warming event. Electron-ion and ion-ion reaction rate coefficients are deduced for the altitude range 60-70 km during a polar cap absorption event. For another PCA the VLF data, when compared with satellite observation of electron and proton fluxes during event onset, indicate rapid access for both types of particles to the northern polar cap. Author

N73-25408# Institut d'Aeronomie Spatiale de Belgique, Brussels.
NITRIC ACID VAPOR ABSORPTION CROSS SECTION SPECTRUM AND ITS PHOTODISSOCIATION IN THE STRATOSPHERE
F. Biaume 1973 22 p refs
(A-117-1973) Avail: NTIS HC $3.25

Absorption cross section values of nitric acid vapor at room temperature were measured at different wavelengths in the 1850 A to 3250 A spectral range. In conjuction with recently published data they lead to a precise HNO3 absorption curve. Estimates, assuming a quantum yield equal to unity, are also given for the nitric acid photodissociation coefficient in the stratosphere. Author

N73-25409# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2, SEPTEMBER 1972
Sep. 1972 18 p
(RRC-A207-Pt-2; SG-80) Avail: NTIS HC $3.00

Ionospheric data obtained with vertical incidence sounding techniques from Indian stations are presented in tabular form. The data is supplemented with such solar and geophysical data as are of interest for ionospheric studies. Author

N73-25410# National Physical Lab., New Delhi (India). Radio Propagation Unit.
SOLAR AND GEOPHYSICAL DATA, PART 2
Oct. 1972 11 p
(RRC-A208-Pt-2; SG-81) Avail: NTIS HC $3.00

Ionospheric data obtained with vertical incidence sounding techniques from Indian stations are presented in tabular form. This information is supplemented with such solar and geophysical data as relate to general ionospheric studies of sunspots, solar flares, and magnetic storms. Author

N73-25411# Bureau of Mines, Washington, D.C.
MINERALS YEARBOOK, 1970. VOLUME 2: AREA REPORTS, DOMESTIC Annual Statistical Report
1972 787 p refs
(PB-214329/5; BM-MYB-170-Vol-2) Avail: NTIS MF $1.45; SOD HC $6.75 as I28.37:97 CSCL 08I

Volume II, Area Reports: Domestic, contains chapters covering the mineral industry of each of the 50 States, the U.S. island possessions in the Pacific Ocean and the Caribbean Sea, the Commonwealth of Puerto Rico, and the Canal Zone. This volume also has a statistical summary chapter and a chapter on employment and injuries. Author (GRA)

N73-25412# Naval Research Lab., Washington, D.C. Aerospace Radar Branch.
DETERMINATION OF OCEAN SURFACE DESCRIPTORS USING SEA PHOTO ANALYSIS TECHNIQUES Final Report on Phase 1, Apr. 1971 - Aug. 1972
R. O. Pilon FAA Oct. 1972 53 p refs
(Contract DOT-FA71WAI-220)
(FAA-RD-72-110) Avail: NTIS HC $4.75

The techniques of sea photo analysis have been utilized to obtain surface truth descriptors of the open ocean from an aircraft. Aerial photographs were taken in such a manner that the density fluctuations of the negatives were related to surface slope. The slope spectra, obtained by Fourier analysis of the negatives, were fitted to an equivalent form of the Pierson-Moskowitz wave height spectrum. The photographs, the wave height spectrum and the rms slope equations determined by Cox and Munk then yielded and averaged heading of the waves, the equivalent wind speed, the rms wave height and the rms slope for clean and slick surfaces. The optical techniques of sea photo analysis used in this program and digital analysis, used when whitecaps were present in the photographs, are discussed. The empirical equations used to determine rms wave height and slope and auxiliary rms slope and wave height spectrum equations are given. Author

N73-25413*# South Alabama Univ., Mobile. Dept. of Mechanical Engineering.
ATMOSPHERIC EFFECTS ON REMOTE SENSING OF NON-UNIFORM TEMPERATURE SOURCES
W. A. McNeill, J. M. Elliott, and B. P. Dixon 22 May 1973 36 p refs
(Contract NAS8-28722)
(NASA-CR-129004) Avail: NTIS HC $4.00 CSCL 04A

The equations of transfer, for a plane-parallel scattering atmosphere with a point source of energy on the lower bounding surface, were solved for various values of sensor/point source orientation and optical depths. Applications of this analysis to Skylab and ERTS mission are discussed, and requirements for atmospheric property data and radiation transfer properties are considered. Author

N73-25414# Delaware Univ., Newark. Coll. of Marine Studies.
COASTAL VEGETATION OF DELAWARE. THE MAPPING OF DELAWARE'S COASTAL MARSHES
V. Klemas, F. C. Daiber, D. S. Bartlett, O. W. Crichton, and A. O. Fornes Mar. 1973 32 p refs Original contains color illustrations
(Contract N00014-69-A-0407; Grants NSF GI-33369; NOAA-2-35223)
Avail: NTIS HC $3.75 CSCL 08F

In view of severe limitations of time and manpower, the

mapping approach used relied heavily on aerial photography and multispectral analysis, utilizing conventional ground reconnaissance only to aid and check the photointerpretation. Work has shown that multispectral image analysis can significantly help, yet not replace, the human interpreter. Suitable imagery from NASA and other sources was available, and a multispectral data processing system was obtained. Author

N73-25415*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROSTATIC FIGURE OF THE EARTH: THEORY AND RESULTS
M. A. Khan Apr. 1973 34 p refs
(NASA-TM-X-66261; X-592-73-105) Avail: NTIS HC $3.75 CSCL 08E

The complete development of the mathematical theory of hydrostatic equilibrium for the earth is recounted. Modifications of the first order theory are given along with the subsequent extension to the second order. In addition, the equations are presented which resulted from a revision of the second order theory to suit the new applications and data types of the post-artificial earth satellite era. D.L.G.

N73-25416*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
DIRECT COMPARISON BETWEEN SATELLITE ELECTRIC FIELD MEASUREMENTS AND THE VISUAL AURORA
Daniel W. Swift and Donald A. Gurnett Jan. 1973 26 p refs Prepared in cooperation with Alaska Univ., Fairbanks
(Contracts NAS5-10625; NAS1-8141; NAS1-2973; Grants NGL-16-001-002; NGR-16-001-043; NSF GA-29158X; NSF GA-1506; Contract N00014-68-A-0196-0003)
(NASA-CR-132958; U-of-Iowa-73-11) Avail: NTIS HC $3.50 CSCL 04A

Electric field data from two passes of the Injun 5 satellite, one corresponding to magnetically quiet conditions and one corresponding to substorm conditions, are compared with simultaneous all-sky-camera data from College, Alaska. In each case, a significant deviation of the electric field from the expected V x B field (where V is the satellite velocity) was evident and a distinct electric field reversal could be identified. In the region of substantial electric field equatorward of the electric field reversal a diffuse auroral arc was observed during the magnetically quiet pass and auroral patches were observed during the substorm pass. The motion of the auroral patches was consistent with the general direction and magnitude of the E x B drift computed from the satellite electric field measurements. In the substorm case the electric field reversal occurred very near a discrete auroral arc at the poleward side of the diffuse arcs and patches. Comparison of the quiet time and substorm cases suggests that the convection electric field penetrates deeper into the magnetosphere during a substorm. Author

N73-25417# National Oceanographic Data Center, Washington, D.C.
MARINE SCIENCE NEWSLETTERS, 1973: AN ANNOTATED BIBLIOGRAPHY
Charlotte Ashby, comp. Apr. 1973 28 p
(NOAA-TM-EDS-NODC-3) Avail: NTIS HC $3.50

A handbook with 94 publications containing news about marine sciences or news of interest to marine scientists was compiled. Some newsletters listed are not primarily marine science-oriented; however, they include information about marine sciences either in respect to the area covered or in respect to the subject matter, such as those that relate to the environment, thus covering also the marine environment. Author

N73-25418*# Scientific Translation Service, Santa Barbara, Calif.
PLOTTING, ADJUSTMENT AND ESTIMATION OF THE ACCURACY OF SPACE GEODETIC NETWORKS
Ye. G. Boyko, B. M. Klenitskiy, I. M. Landis, and G. A. Ustinov Washington NASA May 1973 315 p refs Transl. into ENGLISH of the book "Postroyeniye, Uravnivaniye i Otsenka Tochnosti Kosmicheskikh Geodezicheskikh Setey" Moscow, Nedra Press, 1972 p 1-208
(Contract NASw-2483)
(NASA-TT-F-776) Avail: NTIS HC $6.00 CSCL 08E

The problems of designing, mathematically processing, and determining the accuracy of three-dimensional geodetic nets compiled from synchronous observations of artificial earth satellites are examined. Brief historical information is presented, and the main methods of space triangulation from photographic, laser, and Doppler measurements are described. The a priori determination of the accuracy of elementary figures, series, and continuous nets of space triangulation is discussed. Author

N73-25419*# Aerospace Corp., Los Angeles, Calif.
A NOVEL LASER RANGING SYSTEM FOR MEASUREMENT OF GROUND-TO-SATELLITE DISTANCES
Kurt E. Golden, Dale E. Kind, Stanley L. Leonard, and Roy C. Ward Washington NASA Jun. 1973 63 p refs
(Contract NAS1-11080)
(NASA-CR-2264) Avail: NTIS HC $3.00 CSCL 08E

A technique was developed for improving the precision of laser ranging measurements of ground-to-satellite distances. The method employs a mode-locked laser transmitter and utilizes an image converter tube equipped with deflection plates in measuring the time of flight of the laser pulse to a distant retroreflector and back. Samples of the outgoing and returning light pulses are focussed on the photocathode of the image converter tube, whose deflection plates are driven by a high-voltage 120 MHz sine wave derived from a very stable oscillator. From the relative positions of the images produced at the output phosphor by the two light pulses, it is possible to make a precise determination of the fractional amount by which the time of flight exceeds some large integral multiple of the period of the deflection sinusoid. Author

N73-25420*# Oregon State Univ., Corvallis. Environmental Remote Sensing Applications Lab.
FIRST YEAR PROJECTS AND ACTIVITIES OF THE ENVIRONMENTAL REMOTE SENSING APPLICATIONS LABORATORY (ERSAL) Annual Progress Report, 1 Apr. 1972 - 31 Mar. 1973
Charles E. Poulton and David P. Faulkner 31 Mar. 1973 59 p refs
(Grant NGL-38-002-053)
(NASA-CR-133034) Avail: NTIS HC $5.00 CSCL 08B

Activities, pilot projects, and research that will effectively close the gap between state-of-the-art remote sensing technology and the potential users and beneficiaries of this technological and scientific progress are discussed in light of the first year of activity. A broad spectrum of resource and man-environment problems are described in terms of the central thrust of the first-year program to support land use planning decisions with information derived from the interpretation of NASA highlight and satellite imagery. Author

N73-25421*# Stanford Research Inst., Menlo Park, Calif.
INVESTIGATION OF ATOMIC OXYGEN-SURFACE INTERACTIONS RELATED TO MEASUREMENTS WITH DUAL AIR DENSITY EXPLORER SATELLITES
Bernard J. Wood, C. M. Ablow, and Henry Wise Washington NASA Jun. 1973 53 p refs
(Contract NAS1-10962)
(NASA-CR-2271) Avail: NTIS HC $3.00 CSCL 04A

For a number of candidate materials of construction for the dual air density explorer satellites the rate of oxygen atom loss by adsorption, surface reaction, and recombination was determined as a function of surface and temperature. Plain aluminum and anodized aluminum surfaces exhibit a collisional atom loss probability alpha $<.01$ in the temperature range 140 - 360 K, and an initial sticking probability. For SiO coated aluminum in the same temperature range, alpha $<.001$ and So $<.001$. Atom-loss on gold is relatively rapid alpha $>.01$. The So for gold varies between 0.25 and unity in the temperature range 360 - 140 K. Author

N73-25422*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REMOTE MEASUREMENT OF ATMOSPHERIC TEMPERATURES BY RAMAN LIDAR
Jack A. Salzman and Thom A. Coney 1973 14 p refs Presented at the 5th Conf. on Laser Radar Studies of the Atmosphere, Williamsburg, Va., 4-6 Jun. 1973; sponsored by the Group on

Laser Atmospheric Probing, Am. Meteorol. Soc. in cooperation with the Opt. Soc. of Am.
(NASA-TM-X-68250; E-7507) Avail: NTIS HC $3.00 CSCL 04A

The Raman shifted return of a lidar system was utilized to make atmospheric temperature measurements. The measurements were made along a horizontal path at temperatures between -20 and +30 C and at ranges of about 100 meters. The temperature data were acquired by recording the intensity ratio of two portions of the rotational Raman spectrum which were simultaneously sampled from a preset range. Measurements were made to an accuracy of + or - 3 C with 1 minute temporal resolution. Author

N73-25423# National Physical Lab., New Delhi (India).
SOLAR AND GEOPHYSICAL DATA, PART 2
Apr. 1972 21 p
(RRC-A202-Pt-2; SG-75) Avail: NTIS HC $3.25

Ionospheric data obtained with vertical incidence soundings technique from Indian stations are reported. Part 2 contains solar and geophysical data. Author

N73-25424# National Physical Lab., New Delhi (India).
SOLAR AND GEOPHYSICAL DATA, PART 2
Dec. 1972 9 p
(RRC-A210-Pt-2; SG-83) Avail: NTIS HC $3.00

Ionospheric data, obtained by a vertical incidence sounding technique, from Indian stations are presented. Data tables cover predicted and observed sunspot numbers, optical observations of solar flares, magnetic storms, solar flux, and the effects of sudden ionospheric disturbances on solar flares. E.H.W.

N73-25425# National Physical Lab., New Delhi (India).
SOLAR AND GEOPHYSICAL DATA, PART 2
May 1972 10 p
(RRC-A203-Pt-2; SG-76) Avail: NTIS HC $3.00

For abstract, see N73-25424.

N73-25426*# Denver Research Inst., Colo. Industrial Economics Div.
THE NASA ROLE IN MAJOR AREAS OF HUMAN CONCERN: ENVIRONMENTAL QUALITY
Feb. 1973 17 p refs
(Contract NASw-2362)
(NASA-CR-133049) Avail: NTIS HC $3.00 CSCL 06F

After introducing some of the general factors that have affected progress in the area of environmental quality, NASA program elements are examined to illustrate relevant points of contact. Interpretive steps are taken throughout the report to show a few of the more important ways people's lives have been affected as a result of the work of NASA and other organizations functioning in this area. The principal documents used and interviews conducted are identified. Author

N73-25427# Indian National Scientific Documentation Centre, New Delhi.
PROBLEMS OF SEA CHEMISTRY
V. N. Nikitin, ed. 1972 448 p refs Transl. into ENGLISH of the Publ. "Problemy Khimii Morya" Moscow, Nauka, 1960 272 p Sponsored by NOAA and NSF
(Contract NSF C-466)
(TT-70-57237) Avail: NTIS HC $6.00

The chemistry of sediments and organic matter in the Pacific Ocean and the Bering Sea is considered and the hydrochemical characteristics of the Okhotsk Sea, the White Sea, and the Black Sea are reported. G.G.

N73-25428# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Sep. 1972 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, SEPTEMBRE 1972]
Sep. 1972 31 p In DUTCH and FRENCH
Avail: NTIS HC $3.75

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for September 1972.

N73-25429# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
IONOSPHERIC ELECTRIC FIELD AND CURRENT DISTRIBUTION ASSOCIATED WITH HIGH ALTITUDE ELECTRIC FIELD INHOMOGENEITIES
O. Walter Lennartsson Jan. 1972 48 p refs Submitted for publication
(TRITA-EPP-73-03) Avail: NTIS HC $4.50

A quantitative theoretical analysis of electric field and current distributions in the ionosphere is given, assuming certain time variable convection field profiles at an altitude of 1250 km. A number of idealized assumptions regarding the ionospheric characteristics are defined and discussed. A qualitative discussion of a quasi-stationary configuration with an approximately curl free electric field is also given. Geomagnetically field aligned current densities are consistent with quite reasonable assumptions about the convection field. Oscillations in E with periods of the order of 10 seconds should readily be generated when conductivity is large. Author (ESRO)

N73-25430# Genoa Univ. (Italy). Ist. Geofisico e Geodetico.
GENOA-MONTE-CAPELLINO OBSERVATORY. IONOSPHERIC DATA, JANUARY - DECEMBER 1972
[1973] 64 p Partly sponsored by CNR
Avail: NTIS HC $5.25

Tables of ionospheric data derived from observations made at Genoa-Monte Capellino Observatory, Italy, from Jan. to Dec. 1972 are presented. Both vertical sounding and vertical incidence absorption measurements were made. ESRO

N73-25431# Genoa Univ. (Italy). Ist. Geofisico e Geodetico.
ROBURENT (CUNEO) OBSERVATORY. MAGNETIC BULLETIN, JANUARY - DECEMBER 1972
[1973] 41 p Sponsored in part by CNR
Avail: NTIS HC $4.25

Geomagnetic field direction and intensity were recorded hourly during 1972 using La Cour-type variometers. Tables of data are given. ESRO

N73-25432# Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
PROCESS-FORM VARIABILITY OF MULTICLASS COASTS: BAJA CALIFORNIA
Lynn D. Wright, Harry H. Roberts, James M. Coleman, Romaine L. Kupfer, and L. W. Bowden Feb. 1973 67 p refs
(Contract N00014-69-A-0211-0003)
(AD-756676; TR-137) Avail: NTIS CSCL 08/6

Coastlines display a wide variety of forms, both subaerial and subaqueous, and an equal variation in nearshore processes (waves, tides, currents, etc.) on a worldwide basis. Spatial and temporal variations of these forms and processes along coasts cause considerable problems in planning and successfully executing many naval operations. If the relationships and interdependence between the nearshore processes and the resulting forms were completely understood, relatively accurate predictions could be made of existing conditions given only simple input parameters. This report documents the variablility of coastal processes and resulting shoreline morphology along the peninsula of Baja California, which is used as a test case to examine whether some of the methodology developed can be used in linking process variables and morphology. Author (GRA)

N73-25433# Rice Univ., Houston, Tex.
IONOSPHERIC HEATING ANALYSIS Interim Technical Report, 1 Jun. - 30 Nov. 1972
William E. Gordon and Herbert C. Carlson Griffiss AFB, N. Y. RADC Dec. 1972 35 p refs
(Contract F30602-72-C-0278; ARPA Order 1423)
(AD-758779; RADC-TR-73-82) Avail: NTIS CSCL 04/1

The HF excited plasma line is observed to fluctuate by an order of magnitude about its mean value, the downshifted decay line being about 4/3 the amplitude of the upshifted line. The results obtained by Kantor on the role of the Airy function in explaining one form of the fluctuations has been confirmed. Red line enhancement and suppression in the airglow have been observed. In addition to enhancements of the plasma at and near the plasma line frequency and at the ion line frequency,

enhancements have been observed at the electron gyro-frequency and at twice this frequency. (Author Modified Abstract) GRA

N73-25434# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

USING VHF RADARS TO PROBE THE ATMOSPHERE Environmental Research Papers

Arnold A. Barnes, Jr. 29 Dec. 1972 38 p refs
(AF Proj. 6672)
(AD-758765; AFCRL-72-0749; AFCRL-ERP-426) Avail: NTIS CSCL 04/1

Columns of ions left by the passage of meteors through the 80- to 100-km altitude region are used as tracers to monitor the wind and density variations of the high atmosphere. Recent equipment development with pulse-interferometers operating in the 20- to 75-MHz band has made it possible to obtain more accurate information on the location of the reflection point on the ionized meteor trail. Analyses of the wind and density data obtained at AFCRL, at Stanford, California, Durham, New Hampshire, and Eglin AFB, Florida are reviewed. Rocket and meteor trail wind observations were obtained at Eglin AFB and, for a separation of 150 km, show reasonable comparisons within one hour. Poor comparisons at larger space and time separations are attributed to large-scale horizontal eddies (gravity waves). (Author Modified Abstract) GRA

N73-25435# Space Data Corp., Phoenix, Ariz.

DESIGN, DEVELOPMENT AND FABRICATION OF CHEMICAL RELEASE PAYLOADS Final Report, Apr. 1970 - Nov. 1972

Edward F. Allen, Jr. and Philip E. Beaudoin Dec. 1972 18 p refs
(Contract F19628-70-C-0211; AF Proj. 7635)
(AD-758766; SDC-TM-636; AFCRL-TR-73-0001) Avail: NTIS CSCL 04/1

Rocket borne chemical payload systems were designed, developed, and flight tested to give controlled releases of gases, liquids, solids and explosives. Chemical systems included liquids and gases: trimethylaluminum/triethylaluminum trimethylborane, nickel carbonyl, diborane, iron carbonyl, tetraethyl lead, nitric oxide and carbonyl sulfide; solids: aluminum oxide and chaff; multi-phase reactions of trimethylaluminum and oxygen; solid combustion reactions to vaporize aluminum, barium, beryllium, lithium, magnesium, sodium, strontium; explosive systems to vaporize trimethylaluminum and iron pentacarbonyl; and shaped charge techniques to vaporize aluminum, barium, lithium and iron. Chemical handling techniques were developed and engineering field services were provided to launch support.
Author (GRA)

N73-25436# National Field Investigations Center, Denver, Colo.

REMOTE SENSING STUDY OF THERMAL DISCHARGES TO LAKE MICHIGAN, WISCONSIN, ILLINOIS, INDIANA, AND MICHIGAN

Sep. 1972 77 p Presented at the 14th Session of the Lake Michigan Enforcement Conf., 21 Sep. 1972
(PB-214503/5) Avail: NTIS HC $3.00 CSCL 13B

An aerial reconnaissance study was conducted along pre-designated segments of the shoreline of Lake Michigan to document the extent of thermal discharges from the major electric power plants over the area extending from Muskegon, Michigan, to Twin Creeks, Wisconsin. Nine of the ten plants covered were violating the recommended 3 F maximum temperature increase at the distance of 1,000 feet from an outfall. In addition, six of the power plants were also violating this permitted 3 F increase. It was concluded that the recommendations of the Lake Michigan Enforcement Conference are not being met by many sources of thermal and industrial discharges. GRA

N73-25437# National Field Investigations Center, Denver, Colo.

REMOTE SENSING STUDY OF THERMAL DISCHARGES TO LAKE MICHIGAN: ILLINOIS-INDIANA-MICHIGAN

Oct. 1972 49 p
(PB-214407/9) Avail: NTIS HC $3.00 CSCL 13B

An aerial reconnaissance study was conducted along the shoreline of Lake Michigan from South Haven, Michigan in a clockwise manner through Waukegan, Illinois. The flights were carried out during the afternoon hours on 17 October 1972 and 19 October 1972. The purpose was to document thermal discharges from electric power plants and to see if they were complying with the Lake Michigan Enforcement Conference. It was concluded that the recommendations were not being fulfilled by many sources of thermal and industrial discharges. GRA

N73-25438# City Univ., London (England). Dept. of Aeronautics.

SPACECRAFT-PLASMA INTERACTIONS: INTRODUCTION AND REVIEW OF SIMULATION VALIDITY

A. R. Martin Jan. 1973 71 p refs
(PB-214611/6; Aero-73/1) Avail: NTIS HC $3.00 CSCL 04A

There are three ways in which this interaction can be studied. The first is to conduct in situ measurements in space by using instruments which are carried by a spacecraft. The second method is to numerically solve the equations (Vlasov and Poisson) which describe the spacecraft-plasma interaction using computer techniques. The third method which can be used is that of laboratory simulation. In this a stationary model of a spacecraft is placed in an ion stream moving at constant speed representative of velocities found in the ionosphere. It is concluded that experiments in a facility with good slow-ion suppression and a parallel beam will not only resolve the questions of the validity of previous simulations, but will also extend the knowledge available on the structure and behavior of wakes produced by spacecraft moving an ionized plasma medium. Author (GRA)

N73-25439# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

ICE CRYSTAL MULTIPLICATION IN CONVECTIVE ELEMENTS OF WINTER OROGRAPHIC CLOUDS

Larry Vardiman Jul. 1972 99 p refs
(Grants NSF GI-31460; NSF GI-26401)
(PB-215626/3; CSU-ATSP-191) Avail: NTIS HC $3.00 CSCL 04A

The results of a study are presented on four winter orographic storms which contained precipitation cells, apparently convective in nature, and exhibited varying degrees of ice crystal multiplication. Ice crystal ice nuclei ratios in the cells were computed and studied in relation to cloud top temperature. GRA

N73-25440# Hawaii Inst. of Geophysics, Honolulu.

GEOMAGNETIC TIME-VARIATIONS, THE ISLAND EFFECT, AND ELECTROMAGNETIC DEPTH SOUNDING ON OCEANIC ISLANDS: RESULTS FROM THE ANALYSIS OF DATA OBTAINED IN THE FREQUENCY RANGE OF 0.5 TO 10 CYCLES PER HOUR ON OAHU, HAWAII M.S. Thesis

Douglas P. Klein May 1972 109 p refs
(Grants NSF GF-402; NSF GA-1653; NSF GF-297)
(PB-214444/2; HIG-72-3) Avail: NTIS HC $3.00 CSCL 08N

Geomagnetic time variations in the frequency range of 0.5 to 10 cycles per hour on the island of Oahu show conspicuous spatial differences between locations. These variations are found primarily in the magnetic vertical component; they are explained as a magnetic induction anomaly resulting from electrical currents in the sea which are distorted by the low electrical conductivity of the island of Oahu. By using the Oahu data with computations of the theoretical distorting influence of the island based on the theory of electromagnetic induction in thin sheets, the normal magnetotelluric field relationships. Author (GRA)

N73-25441# Office of the Secretary of Transportation, Washington, D.C.

JOINT ATMOSPHERIC MODELING AND CHEMICAL DYNAMICS WORKSHOP

Reynold Greenstone, ed. and Robert L. Underwood, ed. Nov. 1972 57 p refs Conf. held at Gaithersburg, Md., 12-13 Sep. 1972
(PB-214100/0; DOT-TST-90-2) Avail: NTIS HC $3.00 CSCL 04A

On 12-13 September 1972, the Department of Transportation sponsored a joint atmospheric modeling and chemical dynamics workshop. Concerns of the workshop were to establish a chemical kinetics and atmospheric dynamics data base for use in computational models that would be used to assess possible

climatic effect due to a projected fleet of high-altitude aircraft. New reaction rate data were reported; models were described; and some predictions of climatic effects were made. Areas needing further work were defined. The report summarizes these findings. Author (GRA)

N73-25442# State of New York, Scotia. Atmospheric Sciences Research Center.
STUDY OF MARITIME AEROSOLS
A. W. Hogan, M. H. Degani, and C. Thor 1 Sep. 1972 45 p refs
(Contract EPA-70-64)
(PB-214170/3; EPA-R3-72-025) Avail: NTIS HC $3.00 CSCL 04A

The results are presented of research which was conducted for the purpose of surveying the atmospheric aerosol concentration over the seas, using the information gathered to evaluate the sources and sinks of these particles, and of beginning a chronology of such observations. A portable, photoelectric aerosol detector was supplied to the navigation officer of each cooperating ship. An aerosol observation was made four times each day. Additional data inputs were received from oceanographic ships, ocean station, and island observers. Some of the results of this data are presented. GRA

N73-25443# Hawaii Inst. of Geophysics, Honolulu.
SEASONAL VARIATIONS IN STRUCTURE AND CIRCULATION IN THE RED SEA Ph.D. Thesis
William C. Patzert Aug. 1972 138 p refs
(Grants NSF GA-10277; NSF GA-21171)
(PB-214446/7; HIG-72-13) Avail: NTIS HC $3.00 CSCL 08C

That variations in structure and circulation in the Red Sea along the north-south axis of the sea from the Gulf of Suez to the Gulf of Aden are closely associated with wind stresses acting on the sea surface, is demonstrated in a study of the monthly mean variations occurring in the oceanographic structure and surface circulation in the Sea. Descriptions are presented of the seasonal and/or monthly currents, sea level, temperature, salinity, density, and exchange of mass and heat. Horizontal equations of motion are simplified, in accordance with observed conditions, to help understand the forces that drive the circulation of the Red Sea. Author (GRA)

N73-25444# Hawaii Inst. of Geophysics, Honolulu.
NUMERICAL SIMULATION OF FREE OSCILLATIONS OF ENCLOSED BASINS ON A ROTATING EARTH Ph.D. Thesis
Niels Christensen, Jr. Aug. 1972 195 p refs
(Grants NSF GA-1117; NSF GP-4254; NSF GA-17137)
(PB-214445/9; HIG-72-9) Avail: NTIS HC $3.00 CSCL 08C

Free barotropic oscillations of ocean basins have been studied taking account of the earth's rotation and sphericity and allowing for norizontal divergence and variable bottom topography. Numerical solutions are compared to analytic solutions of a small rectangular basin and of a hemispherical basin centered on the equator. Analytic divergent solutions on a hemisphere are computed and normal modes of a Pacific sized basin and of a basin with a coastal shelf are studied. Author (GRA)

N73-25445# Hawaii Inst. of Geophysics, Honolulu.
A COMPARISON OF ATMOSPHERIC REFRACTIVE INDEX ADJUSTMENTS FOR LASER SATELLITE RANGING M.S. Thesis
Garry A. Schnelzer Sep. 1972 98 p refs
(PB-214447/5; HIG-72-14) Avail: NTIS HC $3.00 CSCL 08E

Different refractive index adjustments for laser satellite ranging are compared for their relative accuracies. A radiosonde least squares curve fitting adjustment is used as a basis for comparing atmospheric model and formula adjustments. A yearly comparison of model and formula adjustments with the least squares adjustment gave the following average differences: Air Force's Cambridge Research Laboratories model, 1.72 centimeters; U.S. Standard Atmosphere, 1962 model, 1.86 centimeters; Empirical model, 1.73 centimeters; Thayer's formula, 2.17 centimeters; and Saastamoinen's formula. 1.07 centimeters. Saastamoinen's formula gives the best comparative result. Author (GRA)

N73-25446# Agency for International Development, Washington, D.C. Office of Science and Technology.
REMOTE SENSING: A DEVELOPMENTAL FRAMEWORK AND CASE STUDIES
Glenn E. Schweitzer Jan. 1973 58 p Presented at CENTO Sem. on the Appl. of Remote Sensing in the Determination of Natural Resources, Ankara, Turkey, 10 Nov. 1971
(PB-214861/7; TA/OST-73-15) Avail: NTIS HC $3.00 CSCL 08B

Assistance is provided for developing country planners and technical specialists in assessing how their countries might participate more effectively in remote sensing activities being supported by the United States and other developed countries. Discussed are: how multispectral techniques can be used by countries with limited investment, trained manpower, and institutional capabilities; and specific activities in three countries which are attempting to apply these advanced techniques to development problems in a very practical way. Author (GRA)

N73-25447# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Aeronomy Lab.
DICHOTOMY IN GEOMAGNETIC DISTURBANCE AND ITS SOLAR ORIGIN Interim Report
Edwin J. Chernosky 8 Feb. 1973 17 p refs
(AF Proj. 7661)
(AD-759791; AFCRL-ERP-435; AFCRL-TR-73-0097) Avail: NTIS CSCL 04/1

The sun has a dominant influence on the terrestrial environment, an environment which affects many phases of direct military interests such as the upper atmosphere, communications, satellite operations, weather, etc. The results obtained add to the interpretation of the solar terrestrial relationships that may add to their predictability. Superposed epoch studies of the daily sunspot numbers (Rz) show a different behavior when selected for daily sums of geomagnetic activity (SKp) of 45 up to 56 than for higher or lower values of SKp. (Author Modified Abstract) GRA

N73-25448# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ATMOSPHERIC MESOSTRUCTURE AND CLEAR AIR TURBULENCE Interim Report
Gary J. Thompson 26 Jan. 1973 24 p refs
(AF Proj. 8628)
(AD-759787; AFCRL-ERP-432; AFCRL-TR-73-0082) Avail: NTIS CSCL 04/1

The mesoscale atmospheric structure in and around regions of clear air turbulence (CAT) is investigated. It is shown that the formation and dissipation of clear air turbulence at several different altitudes is closely related to changes in the atmospheric mesostructure. The turbulence is located in the region of two sloping boroclinic zones and can be attributed to Kelvin-Helmholtz instability resulting from strong wind directional oscillations between these two stable layers. The meteorological sounding data reveal that the lower stable layer and the layer of strong directional oscillations undergo significant upward vertical displacement. The change in turbulence activity can be directly correlated with this motion, and the breakdown of the turbulence and the double stability structure occur almost simultaneously. Author (GRA)

N73-25449# Naval Electronics Lab. Center, San Diego, Calif.
DETERMINATION OF D-REGION ELECTRON DENSITY DISTRIBUTIONS FROM RADIO PROPAGATION DATA Research Report, Apr. 1971 - Sep. 1972
C. H. Shellman 23 Jan. 1973 64 p refs
(AD-759018; NELC-TR-1856) Avail: NTIS CSCL 04/1

A linear method of profile inversion for deducing electron-density distributions is described along with an error analysis to assess accuracy of the resulting distributions. Examples are given of use with both steep-incidence and long-path types of data. Techniques of using ELF sferics data are discussed. Appropriate background material is also given. Author (GRA)

N73-25450# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
SUMMARY OF THE SECOND MAGNETOSPHERIC WAVE PARTICLE INTERACTION WORKSHOP

Billy M. McCormac and John E. Evans Feb. 1973 62 p refs Conf. held at Palo Alto, Calif., 6-8 Feb. 1973
(Contract N00014-73-C-0130; ARPA Order 2260)
(AD-759071; LMSC-D315118) Avail: NTIS CSCL 04/1

A workshop on wave-particle interactions was held at Lockheed Palo Alto Research Laboratory on February 6-8, 1973, under the sponsorship of ARPA and ONR. Wave amplification for communications was discussed. Particular attention was given to the role that wave-particle interactions play in ionospheric-magnetospheric coupling. Experimental techniques to investigate wave-particle interactions were discussed. Author (GRA)

N73-25451# Alaska Univ., College. Geophysical Inst.
SCINTILLATION AND POLARIMETER MEASUREMENTS AT COLLEGE, ALASKA
Robert P. Merritt and George H. Faust, Jr. 14 Nov. 1972 36 p refs
(Contract F19628-71-C-0113; AF Proj. 4643)
(AD-759533; AFCRL-TR-73-0089; SR-1) Avail: NTIS CSCL 04/1

The report summarizes the scintillation and polarimeter measurements being conducted on a routine basis by the Geophysical Institute of the University of Alaska at College, Alaska. The purpose of the contract is to record the behavior of the total electron content of a column of the ionosphere and the scintillation induced on a VHF radio signal passing through that column from a beacon radio transmitter located on the NASA ATS-1 geostationary satellite. Specific events are discussed to indicate the relationship between the scintillation data, the polarization data, and other geophysical phenomena routinely obtained at the Geophysical Institute. (Author Modified Abstract) GRA

N73-25452# SACLANT ASW Research Center, La Spezia (Italy).
GEOPHYSICAL CHARTS OF THE MEDITERRANEAN SEA
Thomas D. Allan and Carlo Morelli 1 Feb. 1973 10 p refs
(AD-757455; SACLANTCEN-SM-2) Avail: NTIS CSCL 08/10

An 80,000 n. mi. geophysical survey of the whole of the Western Mediterranean, the Aegean, and the area south of Crete is presented on 1:750,000 charts of contoured bathymetry, free-air gravity anomalies, simple Bouguer anomalies and total magnetic intensity. The thirty-six charts are available rolled, with a short narrative. References to a longer explanatory test are given. Author (GRA)

N73-25453# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON SOLVING THE SPHERICAL TRANSFER EQUATION
T. Viik 27 Mar. 1973 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk Est. SSR, Ser. Fiz., Mat. (Tallinn), v. 19, no. 3, 1970 p 286-291
(AF Proj. 7351)
(AD-759392; FTD-HT-23-137-73) Avail: NTIS CSCL 04/1

The diffusion of photons is described by the radiation transfer equation, which in the general case is an integral-differential equation. Many approximate methods have been developed for solving this equation, yet an accurate solution has not yet been found for the case of a gray plane-parallel layer or a half-space. In the present article the author examines two approximate methods for solving the transfer equation in the spherical case. GRA

N73-25454# Sparcom, Inc., Alexandria, Va.
LASER TRANSMISSION STUDIES OF EAST COAST WATERS
A. H. Ghovanlou, G. D. Hickman, and J. E. Hogg Mar. 1973 42 p
(Contract N00014-71-C-0202)
(AD-759781; TR-2) Avail: NTIS CSCL 08/10

The transmission of a blue-green laser through waters representing several sites on the east coast of the United States were studied in the laboratory. The primary purpose of this investigation is to establish the capability of an airborne laser-detector system. Scattering transmission distributions of a collimated beam of light were measured in waters in which the turbidity was adjusted by a specific sediment. The turbidity of the waters was characterized by an attenuation coefficient which ranged from 0.07 - 2.0/m and an a/s ratio of 0.08 - 0.30. The reflectivity of the various sediments ranged from 2-20%. The results of the alpha/sediment loading data obtained for the various sediments show a close agreement with the results obtained for quartz. Author (GRA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-25455 National Lending Library for Science and Technology, Boston Spa (England).
NEW INSTRUMENTS AND METHODS OF MEASUREMENT: ELECTRONIC METHODS OF GENERATING SUPERNARROW PULSES
A. S. Koporskii et al 8 Feb. 1973 18 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (Moscow), v. 63, no. 4, 1957 p 801-812
(NLL-DRIC-Trans-2934-(3623.66)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The capacity of electric generators to produce narrow pulses over a wide range of repetition frequencies is treated in terms of various techniques to develop a reliable electric pulse generation system. Among the pulse systems discussed are: the klystron compression type; the beam deflection tube as a supernarrow pulse generator; a combined system generator; and a pulsed generator with magnetic braking. J.M.M.

N73-25456 National Lending Library for Science and Technology, Boston Spa (England).
PHOTOELECTRIC SHIKO TYPE SUNSHINE RECORDER
Amano Ichiro, Keisaburo Koseki, and Kazuo Tamiya [1973] 5 p refs Transl. into ENGLISH from Weather Service Bull. (Tokyo), v. 39, 1972 p 77-79 No diagrams etc. to be used in conjunction with original book
(NLL-M-22979-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The results of testing the present photoelectric sunshine recorder, which had been experimentally constructed by using cadmium sulphide photoconductive cells, indicate that the instrument can now be used officially. A photoelectric sunshine recorder has advantages including the following: (1) The possibility of telemetry; (2) a relatively high accuracy even when absolute luminosity is low in the morning and evening; (3) ease in reading its recording which consists of ON and OFF signals; and (4) ease in maintenance due to the simplicity of its structure. Author

N73-25457 National Lending Library for Science and Technology, Boston Spa (England).
PHOTOELECTRIC TYPE ROBOT-DRIFTED SNOW DEPTH GAUGE
Masanao Anzai [1973] 6 p ref Transl. into ENGLISH from Weather Service Bull. (Tokyo), v. 39, 1972 p 75-77 No diagrams etc. to be used in conjuction with original book
(NLL-M-22978-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The remodelling of a snow depth gage for automatic discrimination of a snow surface is described. Continuous tests were made by several weather stations to determine the degree of automatic discrimination. The depth gage was also tested in combination with the printed circuit of a robot rain gage. Experimental results were highly inaccurate; however, it was concluded that such a system may be used where accuracy is not important. E.H.W.

N73-25458 National Lending Library for Science and Technology, Boston Spa (England).
IMPROVED DIGITAL BAROMETER
Kiichi Yagame [1973] 5 p Transl. into ENGLISH from Weather Serv. Bull. (Tokyo), v. 39, 1972 p 61-63

(NLL-M-22973-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A digital barometer, with an expected accuracy of + or - 0.1 mb, was experimentally constructed for simplification and automation in observing atmospheric pressure. Comparative tests with a mercury barometer show the digital barometer was only about + or - 0.3 mb accurate. The system was redesigned with a self-balancing spring balance system and a weight to eliminate most of the forces in the aneroid. Satisfactory results were obtained in comparative tests with the mercury barometer. Author

N73-25459 National Lending Library for Science and Technology, Boston Spa (England).

CLOCK USED FOR ANTARCTIC LONG-PERIOD AUTOMATIC WEATHER STATION

Yukio Yokota [1973] 7 p refs Transl. into ENGLISH from Weather Serv. Bull. (Tokyo), v. 39, 1972 p 64-66 (NLL-M-22972-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A clock was designed and experimentally constructed as a reserve master clock for driving long-period recording meteorological instruments which were sent to the South Pole in November 1969. The clock is electric winding, lower in accuracy than quartz clocks, and seems to be immune to earthquake vibrations. Other favorable qualities of the clock include low cost for remodelling and its low power consumption. Author

N73-25460* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MAXOMETERS (PEAK WIND SPEED ANEMOMETERS) Patent

John W. Kaufman, Dennis W. Camp, and Robert E. Turner, inventors (to NASA) Issued 8 May 1973 11 p Filed 27 Dec. 1971 Supersedes N72-20392 (10 - 11, p 1472) (NASA-Case-MFS-20916; US-Patent-3,731,531; US-Patent-Appl-SN-212165; US-Patent-Class-73-189) Avail: US Patent Office CSCL 14B

An instrument for measuring peak wind speeds under severe environmental conditions is described, comprising an elongated cylinder housed in an outer casing. The cylinder contains a piston attached to a longitudinally movable guided rod having a pressure disk mounted on one projecting end. Wind pressure against the pressure disk depresses the movable rod. When the wind reaches its maximum speed, the rod is locked by a ball clutch mechanism in the position of maximum inward movement. Thereafter maximum wind speed or pressure readings may be taken from calibrated indexing means. Official Gazette of the U.S. Patent Office

N73-25461* IIT Research Inst., Chicago, Ill.

JUNCTION RANGE FINDER Patent

Sarto Morissette, Ronald G. Sea, and Marvin J. Frazier, inventors (to NASA) Issued 8 May 1973 6 p Filed 21 Sep. 1970 Supersedes N72-15426 (10 - 06, p 0772) Sponsored by NASA (NASA-Case-KSC-10108; US-Patent-3,732,567; US-Patent-Appl-SN-73922; US-Patent-Class-343-14; US-Patent-Class-343-6.8R; US-Patent-Class-343-17.5) Avail: US Patent Office CSCL 14B

An apparatus is described for locating an electrically nonlinear object and determining the distance to the object by transmitting an FM signal in the vicinity of the nonlinear object causing a signal of a higher harmonic to be reflected by the nonlinear object. A receiver is provided for receiving the higher harmonic reflected signal. It is compared with the initial exciting signal so as to produce a signal, the amplitude of which is directly proportional to the distance to the object. Official Gazette of the U.S. Patent Office

N73-25462* Honeywell, Inc., Minneapolis, Minn.

RADIANT SOURCE TRACKER INDEPENDENT OF NON-CONSTANT IRRADIANCE Patent

Fred D. Campbell, inventor (to NASA) Issued 27 Mar. 1973 9 p Filed 28 Dec. 1971 Supersedes N72-20395 (10 - 11, p 1472) Sponsored by NASA Prepared for JPL (NASA-Case-NPO-11686; US-Patent-3,723,475; US-Patent-Appl-SN-212900; US-Patent-Class-250-203R; US-Patent-Class-250-83.3H; US-Patent-Class-250-214; US-Patent-Class-250-214; US-Patent-Class-356-152) Avail: US Patent Office CSCL 14B

A tracker of a radiant source is disclosed. The tracker is composed of a sectored matrix of detectors whose output voltages correspond to their respective levels of irradiance. The voltages are each sampled during a variable length period and the resulting samples are shaped into triangular samples by an integration process. They are supplied to a demodulator which provides an output corresponding to the difference of the time-voltage product of appropriate combinations of the samples. This output, after filtering, represents the angle of incidence on the detectors with respect to a central axis. The triangular samples are also supplied to a demodulator whose output is an AGC voltage which is a function of the sum of the time-voltage integrals of the triangular samples. Official Gazette of the U.S. Patent Office

N73-25463* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INTERFEROMETRIC ROTATION SENSOR Patent

Thomas M. Walsh, inventor (to NASA) Issued 24 Apr. 1973 11 p Filed 21 Jun. 1971 Supersedes N72-21434 (10 - 12, p 1611) (NASA-Case-ARC-10278-1; US-Patent-3,729,260; US-Patent-Appl-SN-154933; US-Patent-Class-356-110) Avail: US Patent Office CSCL 14B

An interferometric rotation sensor and control system is provided which includes a compound prism interferometer and an associated direction control system. Light entering the interferometer is split into two paths with the light in the respective paths being reflected an unequal number of times, and then being recombined at an exit aperture in phase differing relationships. Incoming light is deviated from the optical axis of the device by an angle, alpha. The angle causes a similar displacement of the two component images at the exit aperture which results in a fringe pattern. Fringe numbers are directly related to angle alpha. Various control systems of the interferometer are given. Official Gazette of the U.S. Patent Office

N73-25464 Colorado State Univ., Fort Collins.

ANALYSIS OF JOSEPHSON JUNCTION INTERFEROMETERS Ph.D. Thesis

Don Louis Stuehm 1972 124 p

Avail: Univ. Microfilms Order No. 72-31345

The development of a quantitative method of analyzing Josephson junction interferometers that includes all of the interferometer parameters is presented. Specifically, the two and three junction symmetrical and asymmetrical current feed interferometers are numerically analyzed. The magnetic field characteristics of these interferometers are then related to the length of the Josephson junctions, compared to the Josephson penetration depth, the width of the junctions, and the area of the interference loop. Interferometers with junction lengths of up to 0.7 Lambda sub J and interference loop areas of up to 160 Lambda sub J d sub 1 are presented. The primary contribution of the study is the determination that the interference and diffraction patterns of an interferometer can be obtained from the physical dimensions of the interferometer. Dissert. Abstr.

N73-25465 Pennsylvania Univ., Philadelphia.

REMOTE SENSING AND RF INTERFEROMETRY Ph.D. Thesis

Richard Kenneth Thomas 1972 117 p

Avail: Univ. Microfilms Order No. 73-1459

The determination of the sea height power spectrum by RF interferometric techniques using a bistatic scattering system is discussed. The scattering process produces an angular spectrum of plane waves which is filtered not only by the beamwidth of the interferometer antennas but also by the real angle limitation beyond which the waves are evanescent. The interferometer, with appropriate signal processing, yields a coherence function which is shown to be the Fourier transform of a quantity related to the sea height power spectrum. It is concluded that RF interferometry offers a valid means of determining structural properties of the sea, analogous to the radio astronomy application for measuring brightness distribution. Dissert. Abstr.

N73-25466# Osservatorio Astrofisico di Arcetri, Florence (Italy).
THE ITALIAN 3.5 m TELESCOPE PROJECT
G. Righini 5 Mar. 1971 11 p Presented at ESO/CERN Conf. on Large Telescope Design, Geneva, 1-5 Mar. 1971
Avail: NTIS HC $3.00

The optical parameters of a 3.5 m astronomical telescope are described. The assembly is comprised of primary, Cassegrain, and Coude components. Photographs and diagrams are provided, in addition to a short discussion concerning specifications and objectives. J.M.M.

N73-25467*# McDonnell-Douglas Corp., Long Beach, Calif.
A DEVICE FOR MEASURING TENSILE FORCES Patent Application
Walter T. Appleberry, inventor (to NASA) Filed 21 May 1973 15 p Sponsored by NASA
(NASA-Case-MFS-21728-1; US-Patent-Appl-SN-361907) Avail: NTIS HC $3.00 CSCL 14B

This device is characterized by an elongated body having predetermined elastic properties, so that applied tensile force of any magnitude, within a given range, imparts to the body an elongation of a predetermined length. A sleeve with an axially displaceable nut pinned to it is threaded to the body. The threads of the nut are finer than the threads of the sleeve so that axial advancement of the sleeve relative to the nut is achieved when angular motion is imparted to the sleeve and nut at a common rate. The magnitude of the applied tensile force is indicated as a function of the angular motion applied to the sleeve. NASA

N73-25468*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 SUN SENSOR MODEL DEVELOPMENT AND SIMULATION
L. Schumacher 1 May 1973 51 p refs
(Contract NAS7-100)
(NASA-CR-132990; JPL-TM-33-610) Avail: NTIS HC $4.75 CSCL 14B

The sun sensor flight performance data were analyzed along with the results of a newly developed cruise sensor life in order to better understand cadmium sulfide sun sensor performance. A set of mathematical models was constructed which closely approximated the observed sun sensor flight and laboratory test results. These models revealed, among other things, that (1) the aging phenomena in the sintered cadmium sulfide light detector varies across the detector width in proportion to the illumination history, (2) the current cruise sun sensor design is extremely sensitive to changes in the reflected illumination within the sensor housing, (3) the reflected illumination within the detector housing is proportional to the area and intensity of the solar disk observed at the spacecraft, and (4) the acquisition sun sensor becomes a low impedance path across the sensor bridge when in the vicinity of a large-angular-diameter, low-intensity light source. Author

N73-25469*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER 9 SOLAR ARRAY DESIGN, MANUFACTURE, AND PERFORMANCE
E. A. Sequeira 15 May 1973 63 p
(Contract NAS7-100)
(NASA-CR-132991; JPL-TM-33-615) Avail: NTIS HC $5.25 CSCL 14B

The mission of Mariner 9, the first spacecraft to orbit another planet, was to make scientific observations of the surface of Mars. Throughout this unique mission, the Mariner 9 solar array successfully supported the power requirements of the spacecraft without experiencing anomalies. Basically, the design of the solar array was similar to those of Mariners 6 and 7; however, Mariner 9 had the additional flight operational requirement to perform in a Mars orbit environment mode. The array special tests provided information on the current-voltage characteristics and array space degradation. Tests indicated that total solar array current degradation was 3.5 percent, which could probably be attributed to the gradual degradation of the cover glass and/or the RTV 602 adhesive employed to cement the cover glass to the solar cell. Author

N73-25470# Geological Survey, Washington, D.C.
CALORIMETERS FOR HEAT OF SOLUTION AND LOW TEMPERATURE HEAT CAPACITY MEASUREMENTS
Richard A. Robie and Bruce S. Hemingway 1972 36 p refs
(USGS-PP-755; LC-72-600115) Avail: SOD $0.40

The construction and operation are described of an aqueous solution calorimeter for enthalpy of reaction measurements and a low temperature calorimeter for measuring heat capacities between 10 and 380 K. Heat capacity data are used to calculate the entropy from the third law of thermodynamics. Author

N73-25471# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
PLATINUM RESISTANCE THERMOMETRY
John L. Riddle, George T. Furukawa, and Harmon H. Plumb Apr. 1973 131 p refs
(NBS-Monograph-126; LC-72-60003) Avail: SOD HC $2.10 Domestic Postpaid or $1.75 GPO Bookstore as C13.44:126

Several designs of SPRT's are shown and discussed. Possible sources of error such as those due to the internal and external self-heating effects and the immersion characteristics of SPRT's are described. Precautions and limitations for the mechanical and thermal treatment and for the shipment of SPRT's are indicated, and a guide is given for those desiring the thermometer calibration services of NBS. The description of equipment employed at the National Bureau of Standards for maintaining the IPTS-68 includes the triple point of water cell, tin point cell, zinc point cell, oxygen normal boiling point comparison cryostat, and the 13 to 9 K comparison cryostat. Author

N73-25472*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PVF PYROELECTRIC RADIOMETER
Larry D. Russell May 1973 10 p refs
(NASA-TM-X-62271) Avail: NTIS HC $3.00 CSCL 14B

Polyvinylfluoride (PVF) plastic film was found to be a good pyroelectric material. Radiometers using PVF were developed that exhibit high sensitivity and frequency response. Normalized detectivities of greater than 10 to the 8th power cm/Hz/w and responsivities on the order of 100,000 V/W were measured (500 C BB source, 0.1 Hz chopping frequency and 1 Hz bandwidth.) Author

N73-25473*# Chicago Univ., Ill. Lab. for Astrophysics and Space Research.
IMP F/G(4,5) Final Technical Report
J. A. Simpson 23 May 1973 16 p
(Contract NAS5-9090)
(NASA-CR-132767) Avail: NTIS HC $3.00 CSCL 14B

The development and characteristics of a solid state cosmic ray telescope for use on the IMP F and G missions are discussed. The charged particle telescopes are shown in cross section. The evolution of the telescope from previous instrument developments is described. The performance of the instruments during space missions is analyzed. Author

N73-25474*# Hughes Aircraft Co., El Segundo, Calif.
MULTISPECTRAL SCANNER SYSTEM FOR ERTS: FOUR-BAND SCANNER SYSTEM. VOLUME 1: SYSTEM DESCRIPTION AND PERFORMANCE
V. T. Norwood, L. R. Fermelia, and G. A. Tadler Aug. 1972 133 p
(Contract NAS5-11255)
(NASA-CR-132758; HS-324-5214) Avail: NTIS HC$8.75 CSCL 14B

The four-band Multispectral Scanner System (MSS) is discussed. Included is a description of the MSS with major emphasis on the flight subsystem (scanner and multiplexer), the theory for the MSS calibration system processing techniques, system calibration data, and a summary of the performance of the two four-band MSS systems. Author

N73-25475*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MANUAL FOR 70 mm HAND-HELD PHOTOGRAPHY FROM SKYLAB
Paul D. Lowman, Jr., Herbert V. Frey, William E. Shenk, and

Lawrence Dunkelman May 1973 80 p
(NASA-TM-X-66262; X-644-73-147) Avail: NTIS HC $6.00 CSCL 14B

A manual and atlas used on the Skylab mission for hand-held photography are presented. The manual covers terrain, environmental, meteorological, and dim light photography while the atlas covers sections from the Army Map Service 1:40,000,000 world map, a glossary of geologic terms, geologic maps, and recommended exposure times. Author

N73-25476*# Lockheed-California Co., Burbank.
ORBITAL FATIGUE TESTER FOR USE IN SKYLAB EXPERIMENT T032 Final Report
P. E. Sandorff 15 Jun. 1973 69 p refs
(Contract NAS1-9942)
(NASA-CR-132260; LR-25856) Avail: NTIS HC $5.50 CSCL 14B

A prototype fatigue test machine is described which is suitable for use by an astronaut in conducting constant amplitude materials fatigue tests aboard a Skylab or space shuttle vehicle. The machine is comparised of a mechanical tester, which would be passed through a small (7.6-inch square) airlock to be supported in the space environment on an extendible boom, and a control console, which would provide remote control from within the space vehicle. Author

N73-25477*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT CONDUCTION ERRORS AND TIME LAG IN CRYOGENIC THERMOMETER INSTALLATIONS
I. Warshawsky 1973 16 p refs Proposed for Presentation at the Natl. Conf. and Exhibit of the Instr. Soc. of Am., Houston, Tex., 15-18 Oct. 1973
(NASA-TM-X-68251; E-7515) Avail: NTIS HC $3.00 CSCL 14B

Installation practices are recommended that will increase rate of heat exchange between the thermometric sensing element and the cryogenic fluid, in addition to bringing about a reduction in the rate of undesired heat transfer to higher temperature objects. Formulas and numerical data are given that help to estimate the magnitude of heat conduction errors and of time lag in response. Author

N73-25478*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
DEVELOPMENT OF A BREADBOARD MODEL CORRELATION INTERFEROMETER FOR THE CARBON MONOXIDE POLLUTION EXPERIMENT
M. H. Bortner, R. Dick (Barringer Res., Ltd.), H. W. Goldstein, R. N. Grenda (Barringer Res., Ltd.), and G. M. Levy Mar. 1973 185 p refs
(Contract NAS1-10139)
(NASA-CR-112212) Avail: NTIS HC $11.25 CSCL 14B

The breadboard model of the correlation interferometer for the Carbon Monoxide Pollution Experiment has been designed, fabricated, and tested. Laboratory, long-path, and atmospheric tests which were performed show the technique to be a feasible method for obtaining a global carbon monoxide map and a vertical carbon monoxide profile and similar information is readily obtainable for methane as well. In addition, the technique is readily applicable to other trace gases by minor instrumental changes. As shown by the results and the conclusions, it has been determined that CO and CH4 data can be obtained with an accuracy of 10% using this technique on the spectral region around 2.3 microns. Author

N73-25479# Porto Univ. (Portugal).
SATELLITE TRACKING CAMERA FOR GEODETIC PURPOSES
Jose Osorio and Teresa Torrao 1972 16 p refs
(Publ-27) Avail: NTIS HC $3.00

Details of a small camera for tracking balloon type satellites for geometric geodesy are given along with a description of activities arising from its use. Author

N73-25480# Osservatorio Astronomico, Roma (Italy).
RECONSTRUCTING THE INFORMATION OF RETICULATED SPECTROSCOPY [LA RICOSTRUZIONE DELLE INFORMAZIONI NELLA SPETTROSCOPIA A RETICOLO]
G. A. DeBiase, F. Sacchetti, and D. Trevese Oct. 1972 12 p refs In ITALIAN Presented at 58th Natl. Congr. of the Italian Phys. Soc.
(RR-2) Avail: NTIS HC $3.00

The transfer function of an ideal reticle with an aberration is derived by numerical analysis; this transfer function permits the reconstruction of the spectral distribution obtained by a reticulated spectroscope. The role of noise in this process is discussed, and an optimal filter is determined for the transfer function derived from the synthesis of reticles. A comparison is included of the results for an ideal reticle with those of synthetic reticles. Transl. by F.O.S.

N73-25481*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
ION OPTICAL DESIGN WITH APPLICATIONS TO A SOLAR WIND MASS SPECTROMETER
Michael Coplan Jan. 1973 49 p refs
(Grant NGR-21-002-291)
(NASA-CR-133053; BN-757) Avail: NTIS HC $4.50 CSCL 14B

The design of charged particle beam transport systems at lower energies is discussed. Topics discussed include: index of refraction, photometry, phase space, matrices, lenses and imaging, charged particle trajectories in crossed electric and magnetic fields, design parameters for the Wien filter, and electrostatic energy analyzer design, an annotated bibliography is presented. F.O.S.

N73-25482*# Applied Dynamics Research Corp., Huntsville, Ala.
DESIGN, FABRICATION AND TESTING OF A 5-Hz ACOUSTIC EXCITER SYSTEM Final Report
D. H. Lundy and G. D. Robinson 30 Apr. 1973 34 p
(Contract NAS8-29184)
(NASA-CR-124269; T1046F) Avail: NTIS HC $3.75 CSCL 14B

A 5-Hz acoustic excitation system was designed, fabricated and checked out for use in the modulation of a stagnant gas volume contained in an absorption cell. A detailed system description of the test equipment, both mechanical and electronic, and an operating procedure are included. Conclusions are also presented. Author

N73-25483*# Itek Corp., Lexington, Mass. Optical Systems Div.
PHOTOHELIOGRAPH THERMAL CONCEPTS STUDY. VOLUME 1: SUMMARY Final Report
17 Apr. 1973 17 p
(Contract NAS8-28520)
(NASA-CR-124268; Itek-73-8220-2-Vol-1) Avail: NTIS HC $3.00 CSCL 20F

The performances of thermal subsystem concepts for each of three photoheliograph designs oriented toward unique solar observation missions are defined. These designs and missions may be categorized as: (1) A 150-centimeter photoheliograph for large Solar Observatory (LSO) missions; (2) a 100-centimeter photoheliograph for shuttle sorties; and (3) a 100-centimeter photoheliograph for balloon missions. For each of these photoheliograph designs are the basic thermal environments, boundary conditions, and applicable thermal control concepts defined, the interactions between concepts and environments determined, and a baseline thermal control concept for the three classes of photoheliographs selected. A set of experimental work plans describing the major efforts required to further the detailed design and to confirm analytical performance predictions is included. Author

N73-25484*# Perkin-Elmer Corp., Norwalk, Conn.
LARGE SPACE TELESCOPE ENGINEERING SCALE MODEL OPTICAL DESIGN
Terence A. Facey Apr. 1973 59 p
(Contract NAS8-29312)
(NASA-CR-124561) Avail: NTIS HC $5.00 CSCL 20F

The objective is to develop the detailed design and tolerance data for the LST engineering scale model optical system. This will enable MSFC to move forward to the optical element

procurement phase and also to evaluate tolerances, manufacturing requirements, assembly/checkout procedures, reliability, operational complexity, stability requirements of the structure and thermal system, and the flexibility to change and grow. Author

N73-25485*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
AN EVLAUATION OF THE THREE-DIMENSIONAL SPLIT-FILM ANEMOMETER FOR MEASUREMENTS OF ATMOSPHERIC TURBULENCE
H. W. Tieleman, K. P. Fewell, and H. L. Wood Mar. 1973 148 p refs
(Grant NGL-47-004-067)
(NASA-CR-62093; VPI-E-73-9) Avail: NTIS HC $9.50 CSCL 14B

A three-dimensional split-film anemometer was tested in turbulent, as well as in nonturbulent flow downstream from a wind tunnel turbulence grid. The data obtained with this probe in the turbulence behind the grid, indicated that the measured turbulence intensities were somewhat lower than the intensity measured with the conventional hot-wire anemometry; a result of the finite dimensions of the sensor arrays. The probe yaw angle was determined to be accurate within three degrees. Statistical averages, determined by mean-wind direction and vertical and lateral directions were computed on the basis of the probe yaw angle. Author

N73-25486*# Rocket Research Corp., Redmond, Wash.
MONOLITHIC CATALYST BEDS FOR HYDRAZINE REACTORS Final Report, 12 Nov. 1969 - 28 Feb. 1973
2 May 1973 98 p Prepared for JPL
(Contract NAS7-755)
(NASA-CR-132983; Rept-73-R-360) Avail: NTIS HC $7.00 CSCL 14B

A monolithic catalyst bed for monopropellant hydrazine decomposition was evaluated. The program involved the evaluation of a new hydrazine catalyst concept wherein open-celled foamed materials are used as supports for the active catalysts. A high-surface-area material is deposited upon the open-celled foamed material and is then coated with an active metal to provide a spontaneous catalyst. Only a fraction of the amount of expensive active metal in currently available catalysts is needed to promote monolithic catalyst. Numerous parameters were evaluated during the program, and the importance of additional parameters became obvious only while the program was in progress. A demonstration firing (using a 2.2-Newton (N)(0.5-lbf) reactor) successfully accumulated 7,700 seconds of firing time and 16 ambient temperature starts without degradation. Based on the excellent results obtained throughout the program and the demonstrated life capability of the monolithic foam, it is recommended that additional studies be conducted to further exploit the advantages of this concept. Author

N73-25487# Sandia Labs., Albuquerque, N.Mex.
CONTRAVES CINETHEODOLITE OPTICAL SYSTEM MODIFICATION
R. L. Hughes Jan. 1973 17 p Sponsored by AEC
(SC-DR-72-0754) Avail: NTIS

Minor modifications were found to correct the uneven elevation scale illumination in Models C and D Contraves cinetheodolites. Vignetting by the first relay lens is shown to be the primary cause of the fall-off of illumination from the center to near zero at the edges of the scale. A substitution for the original Contraves lens evens out the illumination to less than 10 percent variation over 85 percent of the scale width. Inclusion of this modification on Models C and D Contraves cinetheodolites has improved the performance of automatic film-reading equipment. Author

N73-25488# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
HIGH PRECISION MASK DUPLICATOR Final Report [DUPLICATEUR DE MASQUES DE HAUTE PRECISION RAPPORT FINAL]
B. Fay 27 Jul. 1971 16 p ref In FRENCH
(Contract DRME-70/34.123.00.480.75.01)
(Rept-3424) Avail: NTIS HC $3.00

The development of integrated circuits requires, at certain exact stages of fabrication, the use of masks with well-defined geometrical characteristics. The masking technique using electron beams is discussed, with emphasis on design structure and beam positioning. An ultrahigh resolution mask duplicator for reproducing master masks onto PPM covered silicon wafer targets is described, and its performance characteristics outlined, together with effect on the industry, and prospects for future developments. ESRO

N73-25489# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.
COCKPIT AND CONTROL: DISPLAY DESIGN CRITERIA FOR TACTICAL STOL AND V/STOL AIRCRAFT Technical Report, 1 Jul. 1971 - 1 Mar. 1972
Joseph S. Musgrave Nov. 1972 155 p refs
(Contract F33615-71-C-1832; AF Proj. ADP-643A)
(AD-758787; D180-14635-1; AFFDL-TR-72-72) Avail: NTIS CSCL 01/4

The unique performance characteristics of the advanced STOL and V/STOL aircraft require a review and analysis of the cockpit, display, and control design requirements. The report presents an analysis resulting in requirements based upon detailed descriptions of a new STOL and V/STOL tactical transport operating in a severe tactical environment. Each item established as a cockpit requirement is the result of a traceable line of development that starts with the new airplane operating requirements and proceeds in directions determined by the capabilities of both hardware and humans. The end product of this analysis is a definition of cockpit display and control requirements based on the new operational needs rather than following the general tendency to use conventional cockpit displays and controls in new aircraft. (Author Modified Abstract) GRA

N73-25490# Washington Univ., Seattle.
REMOTE SENSING AND PHOTOINTERPRETATION
J. E. Colcord 23 Mar. 1972 40 p refs
(Contract DI-14-08-0001-12865)
(PB-214864/1; USGS-IR-255) Avail: NTIS HC $3.00 CSCL 08B

The problems of source, atmospheric attenuation, lens/filter/film or sensor sensitivity, reflectance of targets and the presentation of data are considered in this review on remote sensing. The discussion covers visual wavelengths, black and white and color photography, the photographic or solar IR region, heat IR and microwave imagery. Utilization of photo and other sensor for interpretation is considered showing current trends and the potential of satellite systems such as the ERTS-A.
Author (GRA)

N73-25491# Environmental Research Inst. of Michigan, Ann Arbor.
TECHNIQUES FOR MEASURING LIGHT ABSORPTION, SCATTERING, AND PARTICLE CONCENTRATIONS IN WATER Final Report, May 1971 - Feb. 1973
O. E. Prewett, D. R. Lyzenga, F. C. Polcyn, and W. L. Brown Apr. 1973 39 p refs
(Contract N62306-71-C-1823)
(AD-759668; ERIM-190500-1-F) Avail: NTIS CSCL 14/2

The purpose of the research reported was to investigate the usefulness of multispectral remote sensing techniques in determining the concentration of supended solids in aquatic environments. For the research, aerial photography and multispectral scanner imagery was used to record the upwelling radiation at various locations on the surface of the water. Procedures for determining the concentration of suspended solids are explored. Two techniques are discussed: The first applies to bodies of water that are shallow and fairly clear; The second applies to bodies of water that are deep or very turbid. The first technique is a direct outgrowth of earlier water-depth studies and, when the necessary ground-truth data are available, can also be used to determine water depth or the scattering and adsorption coefficients of the lake. The second has the advantage of requiring less ground truth data for interpretation of the remote measurements. Both techniques are feasible within certain operational constraints. Both give values of the concentration of suspended solids, relative to the concentration at a fixed point, for every location in a body of water for which multispectral data are available. GRA

N73-25492# Army Foreign Science and Technology Center, Charlottesville, Va.
STANDARDIZATION OF GEODETIC INSTRUMENTS AND TECHNICAL PROGRESS IN GEODETIC INSTITUTE
A. V. Rytov 7 Mar. 1973 9 p refs Transl. into ENGLISH from Geod. i Kartografiya (USSR), no. 10, 1971 p 20-24
(AD-759687; FSTC-HT-23-1456-72) Avail: NTIS CSCL 08/5

The report describes standardization of geodesic instruments by the standardization laboratory of the Central Scientific Research Institute of Geodesy, Aerial Surveying, and Cartography. GRA

N73-25493# Boeing Co., Kent, Wash. Aerospace Group.
STRAIN GAUGE TECHNIQUES FOR INTERNAL STRAIN MEASUREMENTS IN BORON-EPOXY COMPOSITES Final Report, May 1971 - Dec. 1972
R. L. Egger Wright-Patterson AFB, Ohio AFFDL Apr. 1973 206 p
(Contract F33615-71-C-1639; AF Proj. 1347)
(AD-759548; D180-15224-1; AFFDL-TR-72-151) Avail: NTIS CSCL 11/4

The report describes a program that was directed toward evaluating and verifying the response of strain gages embedded in boron-epoxy coupons. The primary objective was to fabricate, test and evaluate approximately ninety boron-epoxy tensile specimens containing embedded strain gages. Secondary efforts included improvement of the embedded strain gage design, investigation of embedded single-wire gages, investigation of strain gage embedment and interlaminar shear effects and reporting of materials property data. (Author Modified Abstract) GRA

N73-25494# Department of Housing and Urban Development, Washington, D.C.
[MAPPING, AERIAL PHOTOGRAPHY, AND GROUND SURVEYING RELATED TO URBAN PLANNING AND COMMUNITY DEVELOPMENT] Final Report
15 Dec. 1972 115 p refs
(PB-214305/5) Avail: NTIS HC $3.00 CSCL 13B

The report contains information on urban mapping activities assisted in FY 1972 by the Department of Housing and Urban Development. At the request of the Office of Mangement and Budget, HUD has cooperated in a study by the Federal Mapping Task Force on how best to use government resources to fulfill present and future unmet needs in mapping, aerial photography, and ground surveying in connection with urban planning and community development. Author (GRA)

N73-25495# Airborne Instruments Lab., Deer Park, N.Y.
A 10-MICROMETERS DETECTOR Final Report, 1 Dec. 1969 31 Dec. 1972
W. Chiou, M. Aita, and F. Pace Feb. 1973 145 p refs
(Contract N00014-70-C-0161; ARPA Order 1806)
(AD-759077) Avail: NTIS CSCL 17/5

The purpose of the program performed under this contract is to continue the research on 10.6-micrometer image upconversion detectors and to determine the feasibility of developing a 10.6-micrometer range-gated upconversion imaging laser radar receiver with 150 by 150 resolution elements. To meet the program objectives, the following areas were studied: Experimental determination of the effect of a diverging pump on image resolution for the image space configuration upconverter system and comparison of the results with analytical prediction; Analytical determination of the effect of birefringence and a truncated pump beam on image resolution; development of techniques to handle power dissipation inside the nonlinear crystal; and, investigation of techniques for improvement of optical efficiency. GRA

N73-25496# Airborne Instruments Lab., Deer Park, N.Y.
DETECTOR, 10.6-MICROMETER, ARRAY Final Report, 1 Apr. - 31 Dec. 1972
R. Lange, J. Wolczok, A. DiNardo, R. Augeri, and D. Yustein Feb. 1973 81 p refs
(Contracts N00014-72-C-0446; ARPA Order 1806)
(AD-758714; AIL-0123-F) Avail: NTIS CSCL 17/5

An initial design for a 10 x 10 element heterodyne array was developed using 77 K, 1500-MHz photodiodes. Five PV-HgCdTe 150-MHz MHz photodiodes were then tested on a subassembly of a heterodyne matrix array structure with NEP's below 1.5 x 10 to the minus 19th power W/Hz measured out to 150 MHz. A thermal analysis was performed for 77 and 4.2 K matrix arrays with 150 and 1500 MHz operation to determine the cooler requirement for each case and the effect of the thermal loading on photomixer performance. A thermal mockup of the 77 K, 1500-MHz, 10 x 10 array was tested verifying the multi-cable thermal load analysis, the greater than 30-db isolation between channels, and the greater than 24-hour operating time of the thermal mockup dewar. (Author Modified Abstract) GRA

N73-25497# Army Engineer Topographic Labs., Fort Belvoir, Va.
MAPPING CAMERA IMAGE ERRORS DUE TO STAR CAMERA IDENTIFICATION AND MEASURING ERRORS Research Note, Jun. - Jul. 1971
Michael A. Crombie Jan. 1973 28 p
(DA Proj. 4A6-62707-D-853)
(AD-759491; ETL-RN-73-1) Avail: NTIS CSCL 14/5

The Research Note presents a completely general method for evaluating the performance of a mapping camera which is locked to one or more stellar cameras. Image errors in the mapping camera are expressed as functions of a variety of system errors which include star camera format size and shape, star camera focal length, star image identification and measuring errors, number of measured images, the altitude of the star camera with respect to the mapping camera, and, finally, the attitude of the mapping camera with respect to the local vertical.
Author (GRA)

N73-25498# Kansas Univ./Center for Research, Inc., Lawrence. Remote Sensing Lab.
TEXTURE TONE STUDY. CLASSIFICATION EXPERIMENTS Interim Technical Report
Itshak Dinstein, Robert M. Heralick, S. K. Shanmugam, and D. Goel 31 Dec. 1972 208 p refs
(Contract DAAK02-70-C-0388; DA Proj. 4A6-62707-D-853)
(AD-759505; CRES-TR-182-4; ETL-CR-72-16; ITR-4) Avail: NTIS CSCL 14/5

Four aerial photographic image data sets were classified on the basis of a large class of quickly computable textural features. When the most appropriate features and decision rule were selected, identification accuracy on the order of 75 percent was obtained for 9 to 11 terrain categories. Conclusions drawn from these experiments suggest: That the most powerful features are the entropy and inverse difference features measured at distance 1 and at distance 1/10th the length of the image side; that the class of quickly computable textural features needs to be supplemented by tonal and context features in order for better identification to be obtained. This second conclusion is not to be unexpected since a photointerpreter who tries to make interpretations on the basis of a 1/8 inch x 1/8 inch squared specially processed for high contrast on a 9 inch x 9 inch 1:20,000 aerial photograph does not do any better than 75 percent correct identification as previously reported. Author (GRA)

N73-25499# Naval Postgraduate School, Monterey, Calif.
THIN-FLIM Pb(0.9)Sn(0.1)Se PHOTOCONDUCTIVE INFRARED DETECTORS: PHOTOCONDUCTIVITY MEASUREMENTS M.S. Thesis
Kurt Ervin Holmquist Dec. 1972 129 p refs
(AD-758685) Avail: NTIS CSCL 17/5

Pb(0.9)Sn(0.1)Se thin films were deposited on cleaved CaF2 and BaF2 substrates by vacuum evaporation methods. The as-deposited films were not photosensitive. Photo-conductivity was observed after the films had been isothermally annealed in Pb-Sn rich vapor to reduce their carrier concentrations. Blackbody (500K) response measurements were made to determine the responsivity and detectivity of the thin-film samples. The wavelengths of photoconductive thresholds were determined by spectral response measurement and were in good agreement with the fundamental absorption edges. Photoconductive response times were measured using a GaAlAs heterojunction laser diode as the radiation source. (Author Modified Abstract) GRA

N73-25500*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
END ITEM TEST PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169

J. R. Giles Apr. 1972 48 p refs
(Contract NAS9-11528)
(NASA-CR-128573; T72-19224-Rev-B; S4S-0-679B) Avail: NTIS HC $4.50 CSCL 14B

The test plan defines the tests to be conducted, identifies and describes all test items, and states the objectives of all tests required to verify that the performance and design goals of the Contract End Item Specification, 7232-0009, have been met and that flight hardware is acceptable. Additionally, environmental conditions, testing time or cycles, allowable maintenance, logging requirements, manner of analysis and utilization of test results, disposition of test specimens, retest requirements, location of tests, facilities and support requirements, and the time phasing of the tests are presented. Author

N73-25501*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
FINAL STRESS ANALYSIS REPORT ULTRAVIOLET SPECTROMETER S169
S. Cooper Dec. 1971 173 p refs
(Contract NAS9-11528)
(NASA-CR-128551; T72-19413; S4M-2-250) Avail: NTIS HC $10.75 CSCL 20F

The stress analysis report verifies the structural integrity of the Apollo S-169 UV-spectrometer experiment. The methods by which the various members were analyzed are described. A detailed summary of results for the individual structural elements appears in the form of a table of minimum margins of safety. No negative margins of safety were experienced. It is concluded that the component structure is more than adequate to withstand the environmental load conditions given in the design criteria. Author

N73-25502*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
NONMETALLIC MATERIALS LIST ULTRAVIOLET SPECTROMETER EXPERIMENT (S-169)
Aug. 1972 30 p
(Contract NAS9-11528)
(NASA-CR-128583; T72-19222) Avail: NTIS HC $3.50 CSCL 11D

The final nonmetallic materials summary for the Apollo ultraviolet spectrometer experiment lists manufacture and material specifications, handling and processing criteria, quality test data and approved status as well as curing cycles. G.G.

N73-25503*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
QUALIFICATION PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT (S-169), REVISION A
L. D. Eckard, Jr. Apr. 1972 51 p refs
(Contract NAS9-11528)
(NASA-CR-128572; T72-19223-Rev-A; S4S-0-680A-Rev-A) Avail: NTIS HC $4.75 CSCL 14B

The qualification methods used to verify that the UVS hardware meets the technical requirements of the contract are defined. Included in this plan are test location, the qualification UVS to be tested, test objectives, and all tests required to verify that the UVS meets all performance and environmental requirements of the CEI specification. Additionally, environmental test conditions, testing time or cycles, allowable maintenance, logging requirements, manner of analysis, and utilization of test results, disposition of test specimens, failure criteria, retest requirements, facilities and support requirements, and the time phasing of the tests are presented. Author

N73-25504*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
SPECIAL REPORT, EXIT SLIT MIRRORS FOR THE EBERT SPECTROMETER
William G. Fastie 16 Mar. 1972 20 p refs
(Contract NAS9-11528)
(NASA-CR-128549; T72-19300) Avail: NTIS HC $3.00 CSCL 20F

The use of a very long straight entrance slit in an Ebert grating spectrometer with two plane mirrors at the shorter exit slit to increase the energy density is described. This system has been employed in a far ultraviolet rocket spectrometer to provide higher sensitivity than has been achieved previously. The imaging properties and required slit and mirror adjustments are presented. Experimental results are included. Author

N73-25505*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SYSTEM SAFETY PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169
R. G. Heidelbach Mar. 1971 20 p
(Contract NAS9-11528)
(NASA-CR-128570; T72-19228; SOR-71-002) Avail: NTIS HC $3.00 CSCL 14B

Comprehensive safety program requirements are defined and a methodology for implementing the defined safety tasks in support of the design, development, manufacturing, testing and flight phases of the ultraviolet spectrometer experiment is presented. Author

N73-25506*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
CONTAMINATION CONTROL PROGRAM PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT, REVISION E
D. B. Gilmore Jan. 1972 31 p refs
(Contract NAS9-11528)
(NASA-CR-128575; T72-19227-Rev-E; SOR-70-060-Rev-E) Avail: NTIS HC $3.75 CSCL 14B

The contamination control program plan delineates the cleanliness requirements to be attained and maintained, and the methods to be utilized, in the fabrication, handling, test, calibration, shipment, pre-installation checkout and installation for the ultraviolet spectrometer experiment prototype, qualification and flight equipment. Author

N73-25507*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
TECHNICAL SUPPORTING STUDIES PLAN, REVISION A. TASK 1: PRINCIPAL INVESTIGATOR SERVICES
15 Mar. 1972 16 p
(Contract NAS9-11528)
(NASA-CR-128547; T72-19299) Avail: NTIS HC $3.00 CSCL 14B

Proposed supporting studies for the Apollo 17 UV spectrometer include analyses of existing data and theories to construct lunar atmosphere models; acquisition of information on UV albedo of moon; engineering performance data for prototype Apollo 17 UV spectrometer; UV absolute calibration; and data reduction program interface with lunar atmosphere analysis program. Author

N73-25508*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ACCEPTANCE TEST PLAN FOR THE BENCH TEST EQUIPMENT ULTRAVIOLET SPECTROMETER EXPERIMENT S169, REVISION A
S. D. Baran 15 Oct. 1971 11 p refs
(Contract NAS9-11528)
(NASA-CR-128574; APL-S4S-3-781-Rev-A; T72-19225) Avail: NTIS HC $3.00 CSCL 14B

The test plan outlines the acceptance testing including sequence of testing, responsibilities, and scope of tests for the bench test equipment for the ultraviolet spectrometer experiment. The BTE is classified as mission support equipment. Author

N73-25509*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THERMAL-VACUUM TEST REPORT FOR THE ULTRAVIOLET SPECTROMETER THERMAL MODEL
C. A. Wingate, Jr. 25 Jul. 1972 48 p
(Contract NAS9-11528)
(NASA-CR-128562; APL-S4S-72-094; T72-19135) Avail: NTIS HC $4.50 CSCL 14B

Early design studies showed that the UV spectrometer thermal design margins were very small so that an experimental confirmation of the analytical model would be desirable. At that time the prototype unit was scheduled too far downstream to be of value, so a separate thermal model was built for use in verifying the analytical model. Author

N73-25510*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
QUALITY PROGRAM PLAN FOR THE ULTRAVIOLET SPECTROMETER EXPERIMENT S169, REVISION C
W. W. Vinson Nov. 1971 98 p refs
(Contract NAS9-11528)
(NASA-CR-128584; APL-SOR-70-031-Rev-C; T72-19221) Avail: NTIS HC $7.00 CSCL 14B

The quality progress plan establishes the requirements for a system of controls to assure compliance with the quality assurance requirements as set forth in NASA quality program provisions for aeronautical and space system contractors. Author

N73-25511*# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
INTERFACE DEFINITION FOR THE FAR ULTRAVIOLET SPECTROMETER EXPERIMENT S169 Final Report
Wm. G. Fastie May 1971 25 p
(Contract NAS9-11288)
(NASA-CR-128550; T72-19302) Avail: NTIS HC $3.25 CSCL 14B

A final contract for development, fabrication, test and flight of the ultraviolet spectrometer experiment on an Apollo space mission is reported. Two interface control documents were completed and signed off and three more were essentially completed. Supporting preliminary concepts formulation, design study and component investigation, specification and subcontract negotiation were accomplished. Author

N73-25026 Ministry of Aviation, London (England).
PART 1: A DESCRIPTION OF THE EXCITATION AND RECORDING EQUIPMENT USED FOR FLIGHT FLUTTER TESTS ON A METEOR 8. PART 2: COMPARATIVE FLIGHT FLUTTER TESTS USING THE DECAYING OSCILLATION AND AMPLITUDE RESPONSE TECHNIQUES
P. D. R. Luscombe and W. T. Kirkby *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 899-930 refs Previously issued as RAE-TN-STRUCT-252; ARC-21056; RAE-STRUCT-248; ARC-21158 (For availability see N73-25020 16-01)
(ARC-R/M-3247; RAE-TN-STRUCT-252; ARC-21056; RAE-R-STRUCT-248; ARC-21158)

N73-25029 Ministry of Aviation, London (England).
A PROPOSED APPARATUS FOR MEASURING OSCILLATORY AERODYNAMIC DERIVATIVES
L. H. G. Sterne *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1001-1006 Previously issued as RAE-TN-Aero-2656; ARC-14227 (For availability see N73-25020 16-01)
(ARC-R/M-3260; RAE-TN-Aero-2656; ARC-14227)

N73-25033 Manchester Univ. (England). Dept. of the Mechanics of Fluids.
WAVE THEORY OF THE MACH-ZEHNDER INTERFEROMETER
H. K. Zienkiewicz *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1137-1158 refs (For availability see N73-25020 16-01)
(ARC-R/M-3173)

N73-25553* Radiation, Inc., Melbourne, Fla. Electro-Optics Center.
PHOTOPLASTIC RECORDING MATERIALS IN HOLOGRAPHIC MEMORIES
A. A. Friesem and E. N. Tompkins *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 137-143 refs (For availability see N73-25540 16-16)
CSCL 14E

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-25512* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CABLE RESTRAINT Patent
Harry V. Fuller, inventor (to NASA) Issued 24 Apr. 1973 6 p Filed 17 Dec. 1970 Supersedes N72-15462 (10-06, p 0777)
(NASA-Case-LAR-10129-1; US-Patent-3,729,068; US-Patent-Appl-SN-99201; US-Patent-Class-188-65.1; US-Patent-Class-24-134R; US-Patent-Class-182-5; US-Patent-Class-254-156) Avail: US Patent Office CSCL 13I

A cable guide and restraint device, is described. The device, a reefing system for a pliable tube, is used to freely expand and assist in reefing the tube in a uniform manner.
Official Gazette of the U.S. Patent Office

N73-25513* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NUTATION DAMPER Patent
Jack Evans, inventor (to NASA) Issued 5 Jun. 1973 6 p Filed 18 Jan. 1971 Supersedes N71-31128 (09 - 18, p 2929)
(NASA-Case-GSC-11205-1; US-Patent-3,737,118; US-Patent-Appl-SN-107376; US-Patent-Class-244-1SA; US-Patent-Class-188-266) Avail: US Patent Office CSCL 13I

A nutation damper for use on a spinning body is disclosed. The damper is positioned parallel to the spin axis of the body and radially displaced therefrom. The damper is partially filled with a fluid and contains a porous media to impede the flow of the fluid induced by nutation.
Official Gazette of the U.S. Patent Office

N73-25514# Technische Hogeschool, Eindhoven (Netherlands). Lab. voor Werktuigonderdelen.
THE IMPULSE CAPACITY AS A DESIGN CRITERION FOR FULL JOURNAL BEARINGS UNDER SEVERE DYNAMIC DUTY
H. Blok May 1973 39 p refs
(WTHD-45) Avail: NTIS HC $4.00

Two design criteria, the squeeze-duty and flapping-duty, are studied for full journal bearings under severe dynamic duty. Elastic deformation, performance, and potential use of these criteria to optimize bearing design are discussed. E.H.W.

N73-25515# Technische Hogeschool, Eindhoven (Netherlands). Lab. voor Voertuigtechniek.
THE WHEEL SHIMMY PHENOMENOM: A THEORETICAL AND EXPERIMENTAL INVESTIGATION WITH PARTICULAR REFERENCE TO THE NONLINEAR PROBLEM Ph.D. Thesis, 1966
H. B. Pacejka May 1973 197 p refs Reprinted
(WTHD-48) Avail: NTIS HC $12.00

The shimmy due to tire lateral flexibility occurring in automobiles is discussed. A theory is developed for the stationary and nonstationary behavior of tires, assuming a finite contact area between the tire and the road. The influences of the elasticity of the tread rubber and of the gyroscopio effect of the tire are considered. Three nonlinearities are introduced during rotation of the tire to determine their effects. Full scale tire tests confirmed the accuracy of the theory and it was found that tire and shimmy behavior could be predicted by the theory. Author

N73-25516*# Aerojet Liquid Rocket Co., Sacramento, Calif.
FLUORINE LUBRICATED BEARING TECHNOLOGY Final Report
F. R. Mallaire Jun. 1973 82 p refs
(Contract NAS3-11201)
(NASA-CR-120820) Avail: NTIS HC $6.25 CSCL 13I

An experimental program was conducted to evaluate and select materials for ball bearings intended for use in liquid fluorine and/or FLOX. The ability of three different ball-separator materials,

each containing nickel, to form and transfer a nickel fluoride film to provide effective lubrication at the required areas of a ball bearing operating in liquid fluorine was evaluated. In addition, solid lubrication of a ball bearing operating in liquid fluorine by either a fused fluoride coating applied to all surfaces of the ball separator or by a fluoride impregnation of porous sintered material ball separators was evaluated. Less bearing wear occurred when tests were conducted in the less reactive FLOX. Bearings fabricated from any of the materials tested would have relatively short wear lives and would require frequent replacement in a reusable engine. Author

N73-25517*# Marquardt Corp., Van Nuys, Calif.
STUDY OF MULTIPLE CYCLES VALVES
H. Wichmann May 1973 55 p refs
(Contract NAS2-7361)
(NASA-CR-114627; S-1262) Avail: NTIS HC $4.75 CSCL 13K

A discussion is presented regarding valves which can be cycled repeatedly and are available from industry for application in the inlet system for the Pioneer Venus Probe mass spectrometer. Both solenoid type and latching type valves are considered. The study is divided into two principal areas: (1) preparation of a valve specification reflecting the requirements of the inlet system cyclic valves for the Pioneer Venus Probe mass spectrometer and the submittal of this specification to potential valve suppliers for their response and proposal; (2) preparation of a design layout of an optimum cyclic valve meeting all of the valve specification requirements. Author

N73-25518*# Martin Marietta Corp., Denver, Colo.
CHEMICAL PUMP STUDY
Lyle E. Bergquist Jun. 1973 81 p refs
(Contract NAS2-7383)
(NASA-CR-114594) Avail: NTIS HC $6.25 CSCL 13I

Sorption pumps applicable to the Pioneer Venus Mass Spectrometer Experiment were investigated. The pump requirements are discussed, and a survey of the existing pumps presented. Zirconium and zirconium graphite products were found to be the most promising among the getter materials surveyed. A preliminary pump design for the noble gas experiment is discussed. F.O.S.

N73-25519*# Perkin-Elmer Corp., Pomona, Calif.
CHEMICAL PUMP STUDY FOR PIONEER VENUS PROGRAM Final Report
Mary Rotheram 1973 59 p refs
(Contract NAS2-7380)
(NASA-CR-114604) Avail: NTIS HC $5.00 CSCL 13K

Two chemical pumps were designed for the Pioneer Venus large probe mass spectrometer. Factors involved in the design selection are reviewed. One pump is designed to process a sample of the Venus atmosphere to remove the major component, carbon dioxide, so that the minor, inert components may be measured with greater sensitivity. The other pump is designed to promote flow of atmospheric gas through a pressure reduction inlet system. This pump, located downstream from the mass spectrometer sampling point, provides the pressure differential required for flow through the inlet system. Both pumps utilize the reaction of carbon dioxide with lithium hydroxide. The available data for this reaction was reviewed with respect to the proposed applications, and certain deficiencies in reaction rate data at higher carbon dioxide pressures noted. The chemical pump designed for the inert gas experiment has an estimated volume of 30 cu cm and weight of 80 grams, exclusive of the four valves required for the operation. The chemical pump for the pressure reduction inlet system is designed for a total sample of 0.3 bar liter during the Venus descent. Author

N73-25520*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AUGER ANALYSIS OF OXYGEN AND SULFUR INTERACTIONS WITH VARIOUS METALS AND THE EFFECT OF SLIDING ON THESE INTERACTIONS
Donald H. Buckley Washington Jun. 1973 22 p refs
(NASA-TN-D-7340; E-7411) Avail: NTIS HC $3.00 CSCL 11F

Various gases were adsorbed to copper, aluminum, and chromium surfaces. The gases included oxygen, hydrogen sulfide, methyl mercaptan, and sulfur dioxide. Chemisorption was conducted on static surfaces and during dynamic friction experiments. An Auger cyclindrical mirror analyzer was used to monitor surface films. The sulfur containing gases adsorbed readily to all surfaces. Exposures of as little as 0.000001 (torr)(sec) (1 langmuir) were sufficient to reduce friction. Sliding contact did not affect chemisorption of copper or aluminum but did affect chemisorption to chromium surfaces. Oxygen removed sulfur films from all surfaces at room temperature (23 C). Gaseous exposures were from 0.000001 to 0.01 (torr)(sec) (1 to 10,000 langmuirs). Author

N73-25521*# Atomics International, Canoga Park, Calif.
SPACE NUCLEAR SYSTEM THERMOELECTRIC NaK PUMP DEVELOPMENT
J. L. Johnson 30 Jun. 1973 85 p refs
(NASA Order C-21029-C; NASA Order C-21030-C; Contract AT(04-3)-701)
(NASA-CR-121231; AI-AEC-13091) Avail: NTIS HC $6.25 CSCL 13K

The engineering, design, fabrication, and test history of the dual-throat thermoelectric NaK development pump is summarized, along with the engineering and design status of a similar prototype pump intended for use on the 5-kwe reactor thermoelectric system. The history of dc pump development and testing on previous programs is also summarized. Author

N73-25522*# Rocketdyne, Canoga Park, Calif.
LIQUID HYDROGEN TURBOPUMP RAPID START PROGRAM Monthly Progress Report
G. S. Wong 7 May 1973 20 p
(Contract NAS8-27608)
(NASA-CR-124262; ASR-73-172; MPR-20) Avail: NTIS HC $3.00 CSCL 13K

Effort was directed toward the completion of the coated feed system testing and data analysis of both the uncoated and coated system tests. A total of 11 tests were conducted with the coated feed system during three days of testing. Chill data was acquired for thermal conditioning of the system from ambient initial conditions, using a duct inlet propellent pressure of 72 psig. After three tests to determine steady state pump performance and nominal start transient operation, three coated system turbopump starts were attempted with various degrees of prechill. Author

N73-25523*# Americom, Inc., Northridge, Calif.
EVALUATION OF FORMING AND MANUFACTURING CHARACTERISITICS OF BORON/ALUMINUM MATERIALS Final Report
J. F. Dolowy, Jr. Mar. 1973 23 p
(Contract NAS8-29081)
(NASA-CR-124279) Avail: NTIS HC $3.25 CSCL 13H

Low cost techniques were evaluated for forming boron-reinforced aluminum structural shapes from diffusion-bonded flat sheet and plate. Successful forming was accomplished on fully consolidated material up to .46 cm (0.180) in thick. Five hot section 12 in long were formed from 0.100 thick flat plates 12 in long by 7 in wide. Three of the hat sections were tested in cyclic compression to demonstrate the performance capability of structures by this type of low-cost secondary fabrication. The structural efficiency of these hats was found to be equal or superior to similar structures fabricated by more costly techniques. Author

N73-25524# British Steel Corp., London (England). Metallurgy Dept.
MATERIALS RESPONSE TO FABRICATION: ITS ASSESSMENT AND ITS EFFECT OF SERVICE PERFORMANCE
I. L. Dillamore, F. A. Walker, and M. J. May Jul. 1972 19 p refs Presented at Conf. on the Effect of Mod. Fabric Tech. on the Properties of Steels, Glasgow, May 1972
(PB-214213; MG/18/72) Avail: NTIS HC $3.00 CSCL 13H

Two methods of fabrication are discussed namely, welding and forming. Further development of the fracture machanics based concepts of crack driving energy and material resistance into the regime of residual strains, property gradients and general yielding behaviour are proposed. The assessment of steel for

cold sheet forming operations is considered with reference to simplified descriptions of the important types of stress systems. The important material parameters are discussed, and attention is drawn to the need to consider the total states of stress and strain distribution. Author (GRA)

N73-25525# Mitre Corp., McLean, Va.
SPECTROCHEMICAL OIL ANALYSIS Final Report, through 30 Jun. 1972
D. F. OSullivan Jan. 1973 43 p refs
(Contract DOT-UT-10005)
(PB-216168/5; MTR-6204-Rev-1; OS1) Avail: NTIS HC $3.75 CSCL 11H

A Spectrochemical Oil Analysis Program (SOAP) is a preventive maintenance procedure for engines and transmissions, which has had notable success in many fields. The procedure involves analysis of oil samples both by chemical means and by use of an emission spectrometer. The oil samples are extracted from the engines and/or transmissions of vehicles in operation. The report briefly describes the history of its development, the method of analysis, and its impact upon the maintenance of Naval aircraft, railroads, and buses. Author (GRA)

N73-25526# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE FACTORS AFFECTING THE PROCESS OF HIGH-SPEED DEFORMATION
Yu. P. Sogrishin, L. G. Grishin, V. A. Matyazh, P. A. Meshchanchuk, and V. M. Grishin 22 Mar. 1973 14 p refs Transl. into ENGLISH from Kuznechno-Shtampovochnoe Proizvod. (Moscow), no. 5, 1972 p 5-7
(AF Proj. 7351)
(AD-758619; FTD-HT-23-190-73) Avail: NTIS CSCL 13/8

The article describes the effect of the temperature-speed factor, contact friction, and inertial forces on the process of deformation. GRA

N73-25527# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TECHNOLOGICAL EFFECTIVENESS OF METAL DURING EXTRUSION AS A FUNCTION OF CONDITIONS OF HOMOGENIZATION OF INGOTS
V. I. Dobatkin, Ya. G Grishkovets, and V. I. Yakovlev 4 Apr. 1973 16 p refs Transl. into ENGLISH from the publ. "Legkikh Splavov Metallo Edenie Splavov Legkikh Metallov" Moscow, Nauka, 1970 p 137-143
(AF Proj. 7351)
(AD-759245; FTD-MT-24-960-72) Avail: NTIS CSCL 11/6

The report describes the homogenization processing of aluminum alloy ingots as a means of changing the structure and properties of the semifinished products. GRA

N73-25528# Picatinny Arsenal, Dover, N.J.
USE OF MULTIPLE REGRESSION ANALYSIS TO DEVELOP PREDICTIVE MODELS FOR FAILURE TIMES OF ADHESIVE BONDS AT CONSTANT STRESS. 2: ALUMINUM ADHERENDS
William C. Jones, Elsie McAbee, Raymond F. Wegman, and David W. Levi Mar. 1973 17 p refs
(AD-758845; PA-TM-2066) Avail: NTIS CSCL 13/5

A predictive model was developed for failure times of adhesive-bonded aluminum under a constant stress. The independent variables in the model were temperature, relative humidity, and stress. The coefficients of the model were computed by a multiple regression analysis. The model was shown to be a good predictor of failure times. The performance of a previously developed reaction rate model was also verified by regression techniques. Author (GRA)

N73-25529# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
FABRICATION OF ELASTIC SURFACE DEVICES BY CHEMICAL ETCHING Physical Sciences Research Papers
William J. Kearns and Jose H. Silva 19 Dec. 1972 24 p refs
(AF Proj. 5573)
(AD-758762; AFCRL-72-0731; AFCRL-PSRP-518) Avail: NTIS CSCL 09/1

The fabrication of elastic surface-wave encoders and decoders for use in secure, antijam command, control, and communications systems is described. The processes consist of substrate cleaning, vacuum evaporation of thin aluminum films, photolithography, and chemical etching. Using these techniques, surface-wave interdigital transducer gratings have been fabricated with linewidths as small as 1.5 micrometer. A discussion of the factors affecting the yield of these devices is included. Author (GRA)

N73-25530# Denver Research Inst., Colo.
CENTER FOR HIGH ENERGY FORMING Semiannual Technical Report, 1 Jul. - 31 Dec. 1972
Henry E. Otto Jan. 1973 27 p refs
(Contracts DAAG46-72-C-0130; ARPA Order 720)
(AD-758844; AMMRC-CTR-73-1) Avail: NTIS CSCL 13/8

The report summarizes results obtained during the period 1 July through 31 December 1972 from a metallurgical investigation of explosion welded copper-nickel composites, determination of the optimum parameters for explosion welding A515 steel, analysis and design of an explosion cladding facility, free forming steel domes with D/t ratios of 56 and greater, the mechanics of energy transfer from underwater explosions, the explosive free-forming of arbitrary shapes from thin metal sheets, stress corrosion cracking behavior of explosively deformed austenitic stainless steel, explosive thermomechanical processing of Beta 3 titanium alloy, explosive compaction of nickel base superalloy powders, and dynamic strain measurements on explosively autofrettaged thick walled cylinders. Author (GRA)

N73-25531# Army Chemical Center, Edgewood, Md.
VACUUM BRAZING GAS QUENCHING OF CHEMICAL AND ORDNANCE MUNITIONS Technical Report, Sep. 1967 - Dec. 1970
Francis B. Gurtner Mar. 1973 65 p refs
(AD-759117; EA-TR-4659) Avail: NTIS CSCL 13/8

The vacuum brazing-gas quenching process or vacuum heating-gas quenching process is now a reliable method of joining materials, military and/or commercial hardware items. These hardware items include small munitions for chemicals, ordnance munitions, parts for jet engines, tanks, mortars, vehicle assemblies, and transportation mechanisms such as trucks and personnel carriers. The application of this process indicates quite readily that it is extremely broad, not limited to a small area or scope of endeavor. All that is lacking is the coordinated effort to put this process to work within DOD. The design capability exists for manufacturing, construction, or building a multi-continuous chamber system. The process produces an ultrahigh value when related to quality producibility is 99.99% for a helium leak standard of .000006 cc per second for 15 seconds at one atmospheric differential in pressure. The mechanical properties of the materials of this process are equal to and/or superior to those mechanical properties of the materials processed by conventional methods. The microstructure of each material or of the overall materials are slightly different but serves as an advantage to processing mechanisms for use and functional versatility. (Author Modified Abstract) GRA

N73-25532# Battelle Columbus Labs., Ohio.
APPLICATION OF HOT-ISOSTATIC PRESSING, HYDROSTATIC EXTRUSION, AND DEFORMABLE-DIE TUBE TAPERING PROCESSES TO PRODUCTION OF TITANIUM-6Al-4V TAPERED TUBES
George E. Meyer, George H. Harth, Jerry A. Houck, and Tom G. Byrer Feb. 1973 87 p refs
(Contract DAAJ02-71-C-0038; DA Proj. 1F1-62208-A-170)
(AD-759504; USAAMRDL-TR-72-71) Avail: NTIS CSCL 13/8

The report presents the results of an investigation to determine the potential of hot-isostatic pressing, hydrostatic extrusion, and deformable-die processes for the production of low-cost Ti-6Al-4V titanium helicopter rotor blade spars. GRA

N73-25533# Solar, San Diego, Calif.
TWO-STAGE HIGH PRESSURE-RATIO CENTRIFUGAL COMPRESSOR Final Report
Colin Rodgers Mar. 1973 66 p refs
(Contract DAAJ02-72-C-0014; DA Proj. 1G1-62207-AA-71)
(AD-759499; ER-2415; USAAMRDL-TR-73-4) Avail: NTIS

CSCL 13/7

The report presents the aerodynamic design parameters along with the overall and stage test performances of a small, advanced, two-stage centrifugal compressor designed to attain high pressure ratios with fixed geometry. Complete performance test data was obtained at 60, 70, 80, 90, and 95 percent design speed, showing peak overall temperature rise adiabatic efficiencies of up to 80.5 percent, at pressure ratios between 3.4 and 11.2. Broad compressor flow ranges between surge and choke flows were exhibited, substantiating design predictions that operation at high pressure ratios could be obtained on a two-stage centrifugal compressor without the necessity for variable geometry. (Author Modified Abstract) GRA

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-25534 Michigan Univ., Ann Arbor.
CORRECTION OF PERCEIVED FIRST-ORDER DISTORTIONS IN LONG-WAVELENGTH HOLOGRAPHY Ph.D. Thesis
Donald Charles Winter 1972 117 p
Avail: Univ. Microfilms Order No.72-29239

To analyze the perceived distortions and to design the distortion compensation system, the observer's binocular vision was modeled using a bipolar coordinate system. The analysis suggested that the perceived distortion could be corrected by adjusting the observer's angle of convergence. This hypothesis was examined experimentally, using optically recorded holograms for which the first-order distortions were introduced by varying the reconstruction-beam distance. Three naive observers participated in the experiments. The perceived first-order distortions were eliminated to within the accuracy of the experiments. The theoretical analysis was extended to cover long-wavelength holograms. Several proposed compensation system designs were considered and their capabilities analyzed. Dissert. Abstr.

N73-25535 Polytechnic Inst. of Brooklyn, N.Y.
THEORY OF THE GENERATION AND PROPAGATION OF ULTRA-SHORT PULSES IN LASER SYSTEMS Ph.D. Thesis
Sien Chi 1972 121 p
Avail: Univ. Microfilms Order No. 72-28215

The generation of ultra-short pulses is investigated for two models of laser oscillators: (a) one with a thin-slab of active medium, and (b) one with a distributed active medium. Each of these models consists of a homogeneously broadened two-state active medium in a ring cavity. Cavity losses are modeled by an effective reflectivity of all mirriors for model (a) and by a uniform background conductivity for model (b). Assuming constant velocity for the field envelope and using slowly varying envelope approximation, the periodic solutions of the resulting system of equations are interpreted as self-pulsing laser oscillations. For model (a): The pulse velocity is the velocity is the velocity of light. For model (b): The relationship between pulse velocity and frequency is fixed for a given cavity length by requiring periodicity in both space and time. The pulse velocity and shapes are investigated for inversion levels slightly above the critical values for self-pulsing. Dissert. Abstr.

N73-25536 Florida Univ., Gainesville.
DIRECT NUCLEAR EXCITATION OF A CO2 LASER Ph.D. Thesis
Harold Spencer Rhoads 1972 123 p
Avail: Univ. Microfilms Order No. 73-968

An experimental study of the effects of the helium-3 (n,p) reaction on CO2 laser performance is presented. Laser output power and efficiency are at least doubled by the fast protons and tritons produced in the H-3(n,p)T reaction. The natural helium normally present in the CO2:N2He 1:1:8 gas mixture is replaced with helium-3 and neutrons are supplied by a thermal reactor. The improved performance is observed in discharges with current significantly lower than could be sustained in the absence of radiation. The nuclear reactions also allow the establishment of stable lasing discharges at pressures 40% higher than the 10-torr maximum without nuclear assistance. Breakdown voltage in the 14-torr mixture is reduced by at least 50% during irradiation. The discharge cannot be maintained as reactor power is reduced. An improved technique for calculating the ionization density produced by a volume source of radiation in a cylinder of low pressure gas is derived. Dissert. Abstr.

N73-25537# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
AN ABSOLUTE CALORIMETER FOR HIGH POWER CO2 LASER
P. Boulanger, A. Heym, J.-M. Mayor, and Z. A. Pietrzyk Jan. 1973 10 p refs Sponsored by Swiss Natl. Sci. Found.
(LRP-59/73) Avail: NTIS HC $3.00

An easy to operate absolute calorimeter has been successfully built and calibrated in order to measure the energy output of a high power TEA CO2 laser. The laser beam is completely absorbed in a plastic foil glued on a copper plate. A thermocouple measures the difference of temperature between two separate sandwiches of plexiglas and copper plates, one of them taken as reference. Tested between 1 and 12 joules at 10.6 microns, the device showed an accuracy of 5%. In the best case, the maximum absorbed power could reach 80 megawatts per square centimeter without any visible damage to the calorimeter. Author

N73-25538# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
A DOUBLE DISCHARGE HIGH POWER TEA CO2 LASER
P. Boulanger, A. Heym, J.-M. Mayor, and Z. A. Pietrzyk Feb. 1973 29 p refs
(LRP-60/73) Avail: NTIS HC $3.50

A double discharge TEA CO2 laser of simple design and easy operation has been successfully operated. The output energy is 12 joules and the power is 0.5 gigawatt of linearly polarized light. The influence of the different gas mixtures on the problem of arcing, time delay before lasing and evolution in time of the light pulse, has been investigated. The addition of xylene, made possible the operation of a long and narrow laser configuration. Xylene avoids the formation of arcs in a very efficient way. This permits an increase the input energy in the glow discharge. Author

N73-25539# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE EFFECT OF THE REACTION RATES ON THE GAIN AND POWER OF CO2-N2 GASDYNAMIC LASER IN THE PRESENCE OF H2 AND H2O)
J. Stricker and J. Rom Jan. 1972 52 p refs
(TAE-176) Avail: NTIS HC $4.75

An experimental and theoretical investigation of the effects of the chemical reactions due to H2 in the stagnation region on the CO2 - N2 gas dynamic laser performance is presented. As the rate of H2O production depends on the stagnation conditions, it is found that for stagnation temperature of about 1550 K this rate is such that the water production is negligible during the available test time in the shock tube. It is found that the small signal gain in a nozzle flow can be used for evaluation of the energy transfer rates for CO2 laser action. Author

N73-25540*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HOLOGRAPHY AND OPTICAL FILTERING
Washington 1973 195 p refs Conf. held at Huntsville, Ala., 24-25 May 1971; sponsored in part by the Optical Soc. of Am.
(NASA-SP-299; LC-72-600046) Avail: NTIS MF $0.95 SOD HC $2.85 Domestic Postpaid or $2.50 GPO Bookstore CSCL 20E

Data from the Conference on Holography and Optical Filtering are summarized. Current trends, future possibilities, and applications are outlined. Specific summaries cover use of holography in the fields of astronomy, aerospace engineering, structural analysis, and onboard data processing. For individual titles, see N73-25541 through N73-25560.

N73-25541* Hughes Research Labs., Malibu, Calif.
A PULSED RUBY LASER SOURCE FOR PORTABLE

HOLOGRAPHY
Donald H. Close *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 1-6 refs (For availability see N73-25540 16-16)
CSCL 20E

A portable, self-contained holocamera, measuring 30.5 by 33 by 15.5 cm and weighing 7.9 kg, that uses a mode-controlled, pulsed ruby laser as the illumination source is described. Emphasis is placed on the design and operating characteristics of the laser source, which provides a TEM(00) transverse mode output with a longitudinal coherence length of 25 cm. The small, highly reliable laser was built for a rangefinder system and later modified to provide a high quality source for holography. Author

N73-25542* Union Carbide Corp., New York. Korad Dept.
ADVANCES IN PULSED RUBY LASERS DESIGNED FOR HOLOGRAPHY
E. Gregor *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 7-12 refs (For availability see N73-25540 16-16)
CSCL 20E

Advances made in ruby laser technology to increase the coherence length with temperature controlled multiple etalons and to improve the beam uniformity by growing better ruby crystals are reported. The pulsewidth obtainable was reduced to 2.5 ns without loss of coherence, thus providing shorter holographic exposure times. Large-diameter ruby crystals now available have made it possible to obtain higher energy outputs without reaching the damage threshold. The ruby laser can be readily pulsed with pulse separations down to 2 microns. Environmentally sealed enclosure designs have allowed it to be used in severe industrial environments. Author

N73-25543* TRW Systems Group, Redondo Beach, Calif.
HOLOGRAPHIC INSTRUMENTATION OF TURBINE BLADES
K. R. Overoye and R. Aprahamian *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 15-26 refs (For availability see N73-25540 16-16)
(Contract N00019-70-C-0590)
CSCL 14B

The applicability of laser holographic interferometry to the determination of stresses in turbine blades was investigated. Experiments included continuous-wave holographic interferometry of a statically loaded blade at both room and elevated temperatures (760 C) and a vibrating blade at room temperature. A finite-element computer model of the blade was used to calculate deflections, strains, and stresses in the blade in response to the experiment loads. The holographically measured deflections were compared to the computed deflections and were found to be in good agreement. Actual stresses were then taken to be those calculated by the computer program. The feasibility of obtaining holograms of blades rotating at high speed was investigated analytically and experimentally. Analysis showed that certain optical arrangements or shortened laser pulses were required. Experiments were performed in which holograms were successfully recorded, confirming the analysis and demonstrating that high rates of rotation do not necessarily degrade holographic images. Author

N73-25544* TRW Systems Group, Redondo Beach, Calif.
APPLICATIONS OF HOLOGRAPHY TO WAVE PROPAGATION IN SHELLS AND TO VIBRATION AT HIGH TEMPERATURE c32
D. A. Evensen and R. Aprahamian *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 27-34 refs (For availability see N73-25540 16-16)
(Contracts NAS1-9876; NAS1-10169)
CSCL 20E

Pulsed (double-exposure) holography was applied to measure: (1) flexural waves propagating in circular cylindrical and conical shells and (2) vibration modes of a rectangular plate heated to 566 C (1050 F). The response of the shells appeared nearly axisymmetric at the wavefront, with asymmetric behavior evident well behind the wavefront. Propagation of waves past a circular cutout was also studied. A differential technique (involving two pulses of the laser in rapid succession) was used to record several transverse vibration modes of a heated stainless steel plate. This differential method can record vibrations despite the presence of thermal convection currents surrounding the heated plate. Such measurements (at high temperature and in the atmosphere) are not readily amenable to conventional continuous-wave holography. Author

N73-25545* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF HOLOGRAPHIC INTERFEROMETRY TO SHELL STRUCTURES
J. C. Chen and R. Badin *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 35-37 (For availability see N73-25540 16-16)
(Contract NAS7-100)
CSCL 20E

A holographic interferometry technique was used to measure the prebuckling deformation of a thin-walled cylindrical shell under axial compression. Because of the noncontact mapping and highly sensitive deformation measurement capability of this technique, the extremely small deformations of the shell were developed in great detail. Author

N73-25546* Pratt and Whitney Aircraft, East Hartford, Conn.
HOLOGRAPHIC TECHNIQUES APPLIED TO THE SOLUTION OF AEROSPACE PROBLEMS
Frederick C. Way *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 39-57 refs (For availability see N73-25540 16-16)
CSCL 20E

The use of conventional holographic methods including: (1) routine time-average holographic vibration analysis for determining mode shapes and location of cracks and disbonds, and (2) standard double-exposure holographic interferometry for measuring small displacements and locating flaws is described. Advances in holographic applications and techniques, including real-time motion-picture vibration analysis, contour holography, bleaching to increase diffraction efficiency, and a method for determining holographic system performance, are also presented. A description is given of anticipated future applications of holography such as computer synthesis and redesign of engine components, pulsed ruby holography for flow visualization, and online quality assurance inspection techniques. Author

N73-25547* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A NOVEL HOLOGRAPHIC TECHNIQUE TO RECORD FRONT SURFACE DETAIL FROM A HIGH VELOCITY TARGET
Robert L. Kurtz *In its* Holography and Opt. Filtering 1973 p 59-73 refs (For availability see N73-25540 16-16)
CSCL 20E

A technique which uses an elliptical geometry for the holographic arrangement is discussed. It is shown that the degree of image degradation is not only a function of exposure time but also of the system used. The form of the functional system dependence is given, as well as the results of several systems tested, which verify this dependence. It is further demonstrated that the velocity of the target and the exposure time alone are inconsequential by themselves, and that the important parameter is the total motion of the target (the product of velocity and exposure time). Using the resolution of front-surface detail from a target with velocity of 175.46 m/s, prediction is made of an upper limit on target velocity for resolution of front-surface detail with a given system. Author

N73-25548* Eastman Kodak Co., Rochester, N.Y. Research Labs.
LIGHT SCATTERING IN PHOTOGRAPHIC MATERIALS FOR HOLOGRAPHY c23
Howard M. Smith *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 75-81 refs (For availability see N73-25540 16-16)
CSCL 20F

A simple system for measuring the scattered flux from fine-grained photographic emulsions is described. With this system the Wiener spectrum of sample emulsions is measured for samples varying in grain size, thickness, silver-to-gel ratio, development time, and transmittance. It is shown that the measured results agree well with what is to be expected on theoretical grounds,

and that the functional form of the scattered light is well described by an overlapping circular grain model of the emulsion. Author

N73-25549* Arkansas Univ., Fayetteville. Dept. of Electronics and Instrumentation.
THE QUANTITATIVE MEASUREMENT OF SMALL PHASE DIFFERENCES IN HOLOGRAPHICALLY RECONSTRUCTED OPTICAL FIELDS
G. S. Ballard *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 83-92 refs (For availability see N73-25540 16-16)
(Grant NGL-04-001-007)
CSCL 20F

The final design and performance of a technique for the measurement of small phase differences within holographically reconstructed optical fields are described. The basis of the technique is a method of dual-exposure holographic interferometry which utilizes a separate reference beam for each of the two hologram exposures. This method makes it possible to vary continuously the relative phase of the two beams reconstructed from the double-exposed hologram. Two detectors, placed within the reconstructed field, produce periodic signals which are introduced into an electronic phasemeter, giving a measurement of the relative optical phase difference between the points at which the detectors are located. The precision and stability of the technique are demonstrated, the standard deviation of 60 phase measurements taken over a 30-minute period being 1.4 deg out of 360 deg per wavelength, using light with a wavelength of 632.8 nm. Author

N73-25550* United Aircraft Corp., East Hartford, Conn. Research Labs.
NONDESTRUCTIVE TESTING AND FLOW VISUALIZATION: TWO AEROSPACE APPLICATIONS OF HOLOGRAPHY c12
R. K. Erf, R. M. Gagosz, and J. P. Waters *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 95-120 refs (For availability see N73-25540 16-16)
(Contract NAS1-9926)
CSCL 20D

The application of holography to both nondestructive testing (NDT) and flow visualization is discussed. In the NDT area, particular attention is given to determining the most suitable stress systems for recognizing potential defects within aerospace materials and components when subjected to interferometric holographic examination. It was found that pressure cycling is most appropriate for studying honeycomb structures, diffusion bonds, electron beam and resistance welds, rubber laminates, and solid-propellant-to-liner disbonds; acoustic excitation procedures are preferred for composite bond studies, material thickness measurement, and vibration analysis; and thermal shocking shows promise for the inspection of some composite components. Representative results from these investigations are summarized with the intent of describing the several tools which were developed and are now available for studying the various problems confronting the aerospace industry. Author

N73-25551* ARO, Inc., Arnold Air Force Station, Tenn.
REVIEW OF HOLOGRAPHIC INSTRUMENTATION AT ARNOLD ENGINEERING DEVELOPMENT CENTER
J. D. Trolinger *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 121-128 refs (For availability see N73-25540 16-16)
CSCL 20E

The employment of holographic instrumentation systems at the Arnold Engineering Development Center is discussed. A large number of applications were researched to improve the systems which are presently in use and to determine the feasibility of new applications. Operational systems and research include the application of holography to particle sizing, three-dimensional visualization, flow visualization, nondestructive testing, and optical data processing. A summary of the systems and research is provided and new techniques which have evolved in the development of these systems are discussed. Emphasis is placed on those systems in which holography has provided a data capability which was not obtainable by other methods. Author

N73-25552* Radiation, Inc., Melbourne, Fla. Electro-Optics Center.
APPLICATIONS OF OPTICAL PROCESSING
A. Vander Lugt *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 131-136 (For availability see N73-25540 16-16)
CSCL 20E

A hybrid optical processing system is described which consists of an optical processor capable of handling 5-inch film, a filter-generator for recording spatial carrier-frequency filters on either photographic film or photoplastic material, and an electronic readout system. The readout system consists of a TV camera with an image orthicon tube, a threshold device, a cell generator that partitions the output of the optical system into an array of cells, a PDP-8/I digital computer which organizes, reduces, and displays the data, and a CRT display unit. The computer is also used for controlling optical processing functions. This flexible hybrid system was used for cloud-motion analysis of ATS-3 satellite imagery, for plotting of imagery, for image quality assessment, and for spatial analysis. Author

N73-25553* Radiation, Inc., Melbourne, Fla. Electro-Optics Center.
PHOTOPLASTIC RECORDING MATERIALS IN HOLOGRAPHIC MEMORIES c14
A. A. Friesem and E. N. Tompkins *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 137-143 refs (For availability see N73-25540 16-16)
CSCL 14E

The application of reusable, sensitive, and efficient photoplastic recording materials in read/write holographic memories is reviewed. The composition, preparation, and typical configurations of photoplastics, as well as the techniques for recording and erasing the holographic information, are described. The effects of sample thickness, exposure time, illuminating wavelength, development, and reusability on the holographic signal are examined. Experimental measurements reveal that diffraction efficiencies in excess of 10 percent can be achieved and that the exposure sensitivities and noise characteristics are comparable to high-resolution photographic emulsions. As the number of recording-erasure cycles of photoplastic holograms increases, the signal-to-noise ratio (S/N) of the holographic readout image deteriorates. However, the number of cycles can be over 100 with adequate S/N. Finally, experimental results showing the quality of the reconstructions that can be achieved from a 5 x 5 hologram array are presented. Author

N73-25554* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPLICATION OF COHERENT OPTICAL MATCHED FILTERING FOR DETECTION OF METEOR TRAILS c30
T. H. Gee (Tenn. Univ. Space Inst.), C. W. Allen (Tenn. Univ. Space Inst.), and K. S. Clifton *In its* Holography and Opt. Filtering 1973 p 145-148 refs (For availability see N73-25540 16-16)
(Contract NAS8-24393)
CSCL 03B

Coherent optical matched filter operation as it applies to detection of meteor trails recording via a low-light-level television system was studied. Some of the practical aspects of this problem are considered, including filter selectivity, signal-to-background contrast requirements, and filter sensitivity to rotational changes of the input plane relative to the filter plane. Theoretical results are presented along with supporting experimental data. Author

N73-25555* Sperry Rand Research Center, Sudbury, Mass.
HOLOGRAPHIC PATTERN RECOGNITION: NEW THOUGHTS ON OLD PROBLEMS
H. J. Caulfield *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 149-152 refs (For availability see N73-25540 16-16)
CSCL 20E

Two difficulties which arise in the attempt to apply holographic matched filtering to pattern recognition are: (1) that the pattern location is seldom precise enough to permit matched filtering and (2) that the use of simple threshold circuits to perform the recognition is unreliable. It was found that: (1) when matched filtering is precluded, the next best approach is both easy and

useful, and (2) more complicated recognition circuits produce an increase in system reliability. Author

N73-25556* Tennessee Univ. Space Inst., Tullahoma.
SELECTIVITY AND NOISE EFFECTS IN APPLICATION OF OPTICAL CORRELATION c23
R. O. Webb and F. M. Shofner *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 153-161 refs Sponsored by AF Dyn. Lab. (For availability see N73-25540 16-16)
CSCL 20F

Experimental and theoretical results describing matched filter selectivity for a particular class of signal as obtained, for example, in holographic velocimetry are reviewed. An experiment showing noise rejection is described for filters having both low and high ratios of signal to reference beam. The data are for transmissive signals. Best results are obtained using high ratio filters and high contrast signals. Signal extension derived from diffusely reflecting material objects is treated. By the use of proper optics, the scale change effects of matched filtering are shown to give a quantitative measure of deformation of the strained object. Dependence of sensitivity on signal characteristics is discussed. Author

N73-25557* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ONBOARD OPTICAL DATA PROCESSING FOR SPACECRAFT c23
Akram S. Husain-Abidi *In its* Holography and Opt. Filtering 1973 p 163-171 (For availability see N73-25540 16-16)
CSCL 20F

With onboard satellite use in mind, a system was designed. The main features of the system are the use of off-axis parabolic mirror segments as collimating Fourier-transforming and image-reconstructing elements, and a gallium arsenide laser diode as a point source of coherent electromagnetic radiation. The performance of this system in generating Fourier transform relationships and spatial filtering is very encouraging. Author

N73-25558* Arkansas Univ., Fayetteville. Graduate Inst. of Technology.
OPTICAL CORRELATION EVALUATION OF SURFACE DEFORMATION DUE TO FATIGUE c32
Robert L. Bond, Robert E. Beissner (Southwest Res. Inst.), James Lankford, Jr. (Southwest Res. Inst.), and William W. Bradshaw (Southwest Res. Inst.) *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 177-182 ref (For availability see N73-25540 16-16)
CSCL 20K

Coherent optical correlation techniques were applied to the detection and evaluation of microstructural surface alterations during cyclic stressing of Fe-3Si. Correlation data were obtained by measuring the light intensity in the central portion of the optical correlation function, at various cyclic intervals, using a holographic filter made with the wavefront reflected by the specimen in its original uncycled, preload condition. The changes in correlation intensity were supplemented by measurements of the spatial frequency spectrum of the reflected beam, and changes in both sets of measurements were correlated with optical microscopy and surface interferometry, and also with electron replica microscopy, of the surface topography. The results are discussed in terms of cumulative fatigue damage and ultimate fatigue crack initiation. Author

N73-25559* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLDER JOINT FATIGUE MEASUREMENT BY OPTICAL CROSS CORRELATION c32
Rodney W. Jenkins and Melvin C. McIlwain *In its* Holography and Opt. Filtering 1973 p 183-192 refs (For availability see N73-25540 16-16)
CSCL 20K

Optical cross-correlation, because of its nondestructive nature and shorter time requirement, offers promise as both a qualifying test for the design of printed circuit boards and an inspection test for the boards to be used on space flights. Using optical cross-correlation, measurements can be made of the relative component movements and deterioration of the solder joint surface under thermal loading. The results obtained in a program using these techniques are presented. Author

N73-25560* ARO, Inc., Arnold Air Force Station, Tenn.
AN INVESTIGATION OF THE REAL IMAGE OF AN APERTURE-LIMITED, IN-LINE FRAUNHOFER HOLOGRAM
Ronald A. Belz *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 193-202 refs (For availability see N73-25540 16-16)
(Contract F40600-72-C-0003)
CSCL 20E

The intensity distribution in the neighborhood of the real image of an aperture-limited, in-line Fraunhofer hologram is described. Theoretical data are presented in the form of isophote diagrams. Each diagram is dependent only on the amount of particle information recorded and not on the recording parameters. Diagrams of the intensity along the reconstruction axes are included. From the theory, the conditions under which the image size measurement error is zero are found. In addition, the depth of field of the image is also determined and is found to be similar to that of the real image of a thin lens. The theoretical analysis shows excellent agreement with experimental data. Author

N73-25561*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PHASED-ARRAY LASER RADAR: CONCEPT AND APPLICATION
Kenneth A. Kadrmas 8 Jun. 1973 36 p refs
(NASA-TM-X-64753) Avail: NTIS HC $4.00 CSCL 20E

The design and construction of a coaxial transmitter-receiver combination was investigated. Major emphasis was placed on simple permanent optical alignment, transmitter-receiver field of view matching, use of a pulsed gas laser as a transmitter maximum optical efficiency, complete digital control of data acquisition, and optical mount pointing and tracking. Also a means of expanding the coaxial transmitter-receiver concept to allow phased-array lidar, par-lidar was described. Author

N73-25562# Defence Standards Labs., Maribyrnong (Australia).
THE PERFORATION OF THIN METAL SHEETS BY A CONTINUOUS-WAVE CARBON-DIOXIDE LASER
D. R. Skinner and R. E. Whitcher Dec. 1972 31 p refs
(Rept-534) Avail: NTIS HC $3.75

A 2-kw continuous wave carbon dioxide laser was used to investigate the energy density required to perforate a thin metal sheet as a function of pulse length for long pulses (0.02 to 1.3 s). Experimental results were compared with a simplified solution of the thermal-conductivity equation, and reasonable agreement was found in the cases of nickel, steel and aluminium. Titanium required a much greater energy density than predicted by the mathematical model. Author

N73-25563# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF THE COUPLING ORIFICE OF A CO2 GAS LASER CAVITY OPERATING IN THE MODE OF EXCITATION BY MICROSECOND PULSES, ON THE OUTPUT POWER
K. I. Krylov, Iu. A. Baloshin, and N. E. Averianov [1973] 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Priborostr. (USSR), v. 16, no. 3, 1973 p 122-127
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The results are presented of experiments to determine the dependence of the output power on the diameter of the coupling orifice. The efficiency of cavities of identical geometry in the pulsed and continuous modes was compared. The experimental results indicate the following: (1) From the standpoint of output power, the optimal parameters of a cavity with a pulsed mode differ from their values in the continuous mode. The coupling orifice diameter optimal for maximization of the output power in the pulsed mode is less than that for the same cavity in the continuous mode. (2) The selection of cavity parameters depends on the specific state of the active medium. This state is determined by the nature of active medium excitation and the specific mixture parameters. D.L.G.

N73-25564*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A LASER HEAD FOR SIMULTANEOUS OPTICAL PUMPING OF SEVERAL DYE LASERS Patent Application
Peter B. Mumola and Belton T. McAlexander, inventor (to NASA)
Filed 5 Jun. 1973 11 p
(NASA-Case-LAR-11341-1; US-Patent-Appl-SN-367293) Avail: NTIS HC $3.00 CSCL 20E

The development of a laser head for simultaneous optical pumping of several dye lasers is discussed. The components of the system and method of operation are described. Illustrations of the equipment are provided. Placing a flashlamp along the common focal axis of a multi-elliptical cylinder cavity and placing a dye laser along each of the other focal axes of the cavity which enables the single flashlamp to supply the optical energy to all of the dye cell lasers. NASA

N73-25565# Institut Franco-Allemand de Recherches, St. Louis (France).
MICROHOLOGRAPHIC ABERRATIONS [ABERRATIONS EN MICROHOLOGRAPHIE]
R. Schirrer and P. Smigielski 21 Nov. 1972 16 p refs In FRENCH
(Contract DRME-72/329)
(ISL-32/72) Avail: NTIS HC $3.00

In order to verify experimentally and apply to ultrahigh speed microparticle holograms the wide-angle aberration theory, as in the case of recording wavelength different from the restitution wavelength, various mountings were investigated. It was shown that the off-axis holographic mounting was suitable to restitute the maximal microparticle volume with the optimum resolution. ESRO

N73-25566# Institut Franco-Allemand de Recherches, St. Louis (France).
THEORETICAL AND EXPERIMENTAL CONSIDERATIONS ON THE HOLOGRAPHY OF MOVING OBJECTS. APPLICATION TO HIGH-SPEED MICROHOLOGRAPHY CONSIDERATIONS THEORIQUES ET EXPERIMENTALES SUR L'HOLOGRAPHIE DES OBJETS EN MOUVEMENT. APPLICATION A LA MICROHOLOGRAPHIE ULTRA-RAPIDE]
P. Smigielski 2 Jan. 1973 38 p refs In FRENCH
(Contract DRME-72/329)
(ISL-1/73) Avail: NTIS HC $4.00

The theory on the effects of object motion on the holographic image quality is presented based on the object nature and on the lighting modes. The problems due to microparticles propagating at high speeds are discussed. Various holographic mounting performances were analyzed based on the study of resolution limitations due to particle motion, light diffraction, and particle nature. It is shown that the non-diffuse transmission light holographic mounting is the most suitable for studying high-speed microparticles. ESRO

N73-25567# Institut Franco-Allemand de Recherches, St. Louis (France).
HIGH-SPEED MICROHOLOGRAPHY Final Report MICROHOLOGRAPHIE ULTRA-RAPIDE (RAPPORT DE SYNTHESE FINAL)]
F. Albe and P. Smigielski 16 Jan. 1973 17 p refs In FRENCH
(Contract DRME-72/329)
(ISL-3/73) Avail: NTIS HC $3.00

The influence of aberrations, motion, and lighting mode on the restituted image quality was investigated. Various holograms of opaque and transparent, motionless and high speed (200 m/sec) microparticles were recorded using a pulsed ruby laser (100 mJ in 20 nsec). Gabor geometry mounting, reflected light and diffuse light transmission mounting were used. The images were restituted using a 50 mW He-Ne laser and were enhanced using a closed circuit television system. It has been shown that the non-diffuse light transmission holographic mounting is the most suitable for studying high speed microparticles. Using such a mounting it was possible to visualize 40 micron particles propagating at a 200 m/sec speed. ESRO

N73-25568# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DESIGNS AND EXPERIMENTS RELATING TO STABLE GAS LASERS
Charles Freed 1 Mar. 1973 37 p refs
(Contract F19628-73-C-0002; ARPA Order 600)
(AD-758774; TN-1973-14; ESD-TR-73-65) Avail: NTIS CSCL 20/5

The report describes some of the advances in the design and performance of stable gas lasers. The construction and output characteristics of highly reproducible, stable, selectable single transition grating-controlled CO2 and CO lasers are described. Experiments on short-term stability, standing wave saturation resonances, pressure and power broadening, pressure shift and long-term stabilization of CO2 lasers are discussed. Author (GRA)

N73-25569# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
[EXTENSION OF USEFUL FREQUENCY SPECTRUM FROM MICROWAVE TO OPTICAL FREQUENCIES] Consolidated Quarterly Report, 1 Jan. - 31 Mar. 1972
J. R. Boye, P. W. Chen, C. H. Durney, O. P. Gandhi, R. W. Grow, J. L. Hou, W. G. Krigbaum, R. O. Miles, and E. F. Owen 31 Mar. 1972 107 p refs
(Contracts N00014-69-C-0345; N00014-67-A-0325-0005)
(AD-758914; MDL-Q40; UTEC-MD-72-186) Avail: NTIS CSCL 20/5

The broad purpose of the research activity reported herein is to extend the useful frequency spectrum into the range from microwave frequencies to optical frequencies and to improve existing devices and techniques in the microwave spectrum. At present this objective is being pursued by studies of electron beam devices, quantum electronic devices, plasmas, and solid-state devices. Author (GRA)

N73-25570# Avco-Everett Research Lab., Everett, Mass.
CARBON MONOXIDE LASER
Robert E. Center Apr. 1973 31 p refs
(Contract N00014-72-C-0030; ARPA Order 1807)
(AD-759755) Avail: NTIS CSCL 20/5

The report describes the development of a 20 liter cooled CO laser designed for pulsed operation with pressures up to 1 atmosphere. An electron beam sustained discharge is used for the gas excitation. Pulsed output energies up to 1 kilojoule have been observed and the results are compared with the theoretical predictions based on a kinetic model for the CO laser. Author (GRA)

N73-25571# Wayne State Univ., Detroit, Mich. Research Inst. for Engineering Sciences.
MODELING OF CO/N2 MOLECULAR LASER SYSTEMS Semiannual Technical Report, 30 Jun. 1972 - 25 Jan. 1973
Edward R. Fisher, Allan Lightman, and Richard Marriott 6 Feb. 1973 33 p refs
(Grant DA-ARO(D)-31-124-72-G103; ARPA Order 675)
(AD-759509) Avail: NTIS CSCL 20/5

Over the past three years an extensive molecular laser modeling code has been developed under ARPA sponsorship. This model characterizes the time evolution of pulsed molecular laser systems including the effects of non-Boltzmann electron distributions, stimulated emission processes, temperature and density transients and state-of-the-art energy transfer rate coefficients. During the last year a laboratory effort has been developed to complement these analytic studies. The report describes the results obtained from the modeling studies and the current status of the laboratory effort. Author (GRA)

N73-25572# Hughes Research Labs., Malibu, Calif.
A 10.6 MICROMETER LASER COMMUNICATION SYSTEM Final Report, 31 Aug. 1971 - 30 Nov. 1972
F. E. Goodwin and T. A. Nussmeier Feb. 1973 112 p refs
(Contract DAAB07-72-C-0051; DA Proj. 156-62701A-448-0510)
(AD-759483; ECOM-0051-F) Avail: NTIS CSCL 17/2

The report summarizes work performed from September 1971 through December 1972, a 1-year effort to design, fabricate, and test an experimental 10.6 micrometer laser communication system. The system consists of a transmitting terminal and a receiving terminal which provide a simplex 5 Mbit/sec data channel over a 5-mile terrestrial path with an error rate of 10

to the minus 6th power in all except the most severe weather conditions. The system utilizes intracavity electro-optic modulation with a frequency shift keying format and optical FM heterodyne detection using a mercury-cadmium-telluride (HgCdTe) detector operating at 77K. The details of the system design and performance over a nominal 5-mile path and a 20-mile path are given. Author (GRA)

N73-25573# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SHORT TERM AVERAGE OPTICAL BEAM SPREAD IN A TURBULENT MEDIUM Research Report, Aug. - Sep. 1972
Hal T. Yura 15 Dec. 1972 30 p refs
(Contract F04701-72-C-0073)
(AD-759804; TR-0073(3230-30)-3; SAMSO-TR-73-138) Avail: NTIS CSCL 20/5

On the basis of the extended Huygens-Fresnel principle, a general expression is derived for the short-term average optical beam spread, as measured with respect to the instantaneous center of energy of the beam, of an initially coherent optical beam wave propagating in a weakly inhomogeneous medium. The present analysis applies to the near field of the effective coherent transmitting aperture, where the beam wanders (dances) as a whole and does not break up into multiple patches or blobs. Central to the analysis is the short-term average mutual coherence function (MCF) of a spherical wave. This quantity is obtained from the corresponding long-term MCF by removing the random tilt of the wave front. Analytic expressions for the short-term beam spread are presented for the case of a Kolmogorov spectrum and the short-term average MCF derived by Fried. (Author Modified Abstract) GRA

N73-25574# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE EFFECT OF GRAVITY UPON THE MELT-THROUGH TIME OF A SOLID SUBJECTED TO A HIGH INTENSITY LASER M.S. Thesis
Gilbert L. Camburn Mar. 1972 95 p refs
(AD-759168; GAM/MC/73-6) Avail: NTIS CSCL 20/13

An analysis was made of the effect of gravity upon the melt-through time of a solid subjected to a high intensity laser. The analysis was accomplished by dividing a slab into a number of finite elements and performing an energy and force balance for each finite element, resulting in a computer-programmed mathematical model. Two metals, aluminum and titanium, each having a thickness of either 0.08 or 0.127 cm, were considered using absorbed peak intensities that ranged from 2,000 to 256,000 watts/sq cm. The effect of gravity upon the melt-through time was found to be dependent upon the physical properties of the solid, the magnitude of the absorbed peak intensity, the thickness of the solid and, to a lesser degree, upon the type of distribution of the incident radiation. (Author Modified Abstract) GRA

N73-25575# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENT OF VIBRATIONAL TEMPERATURES IN A CO LASER
A. A. Mikaberidze, V. N. Ochkin, and N. N. Sobolev 11 Apr. 1973 23 p refs Transl. into ENGLISH from Tr. Akad. Nauk SSSR, Fiz. Inst. (USSR), no 54, 1972 p 1-24
(AF Proj. 649L)
(AD-759237; FTD-MT-24-1726-72) Avail: NTIS CSCL 20/5

The possibility of obtaining high powers in the spectrum region of 5-6 micrometers with CO molecules causes interest in research on the mechanism for creation of an inversion in a CO laser. In this work the authors determine vibrational temperatures by the method of the inversion of spectral lines in the infrared region of the spectrum which automatically considers reabsorption and does not require the resolution of the vibrational-rotational spectrum. GRA

N73-25576# Northrop Corp., Hawthorne, Calif.
UV GAS LASER STUDIES
M. L. Bhaumik and E. R. Ault Mar. 1973 27 p refs
(Contract N00014-72-C-0456; ARPA Order 1807)
(AD-759069; NRTC-73-16R) Avail: NTIS CSCL 20/5

The report describes the experimentally observed laser oscillations in the vacuum ultraviolet obtained from high pressure xenon gas under E-beam excitation. GRA

N73-25577# Aerospace Corp., El Segundo, Calif. Lab. Operations.
HF LASER FLOW VISUALIZATION WITH AN INFRARED TELEVISION SYSTEM Research Report, Jun. 1969 - Dec. 1972
Munson A. Kwok and Edward F. Cross 16 Apr. 1973 31 p refs
(Contract F04701-72-C-0073)
(AD-759803; TR-0073(3430)-16; SAMSO-TR-73-161) Avail: NTIS CSCL 20/5

An infrared television system for the observation of HF continuous chemical laser gas flows is described. The primary objective of these experiments was the flow visualization of the supersonic free jets provided by the infrared HF emissions generated by the reaction of hydrogen and fluoride flowing out of selected nozzle configurations. The spatial flow patterns for three HF laser configurations were observed and monitored with this system. The mechanical configuration, optics, and operating parameters associated with each configuration are discussed, and HF medium uniformity and jet properties are described. Author (GRA)

N73-25578# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CO LASER. THE FORMATION MECHANISM OF POPULATION INVERSION
N. N. Sobolev and V. V. Sokovikov 10 Apr. 1973 48 p refs Transl. into ENGLISH from Tr. Akad. Nauk SSSR, Fiz. Inst. (Moscow), v. 67, 1972 p 1-61
(AD-759679; FTD-MT-24-1733-72) Avail: NTIS CSCL 20/5

The article investigates the formation mechanism of vibrational level population inversion in gas-discharge CO-lasers operating at room temperature and at the temperature of liquid nitrogen. Considerable space is allotted to an exposition of the presently available theoretical and experimental data on the probabilities of vibrational transitions in molecules. The works, in which calculations of the populations of vibrational levels in the CO-laser were carried out, are discussed in detail. (Author Modified Abstract) GRA

N73-25579# Texas Univ., Dallas.
INVESTIGATION OF THE FEASIBILITY OF THE ELECTRON BEAM-EXCITED, HIGH-PRESSURE RECOMBINATION LASER
Carl B. Collins, Austin J. Cunningham, and Brian W. Johnson Apr. 1973 31 p refs
(Contract N00014-67-A-0310-0007; ARPA Order 1807)
(AD-759399; UTDP-A003-1.1) Avail: NTIS CSCL 20/5

The report describes research applied toward the determination of the feasibility of developing a recombining, electron beam-excited plasma into a pulsed laser of exceptionally high peak power. The indication of small signal gain for optical amplification at 5875 A is the principal subject of this supplement. Author (GRA)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-25580 National Lending Library for Science and Technology, Boston Spa (England).
IRON-NICKEL-MOLYBDENUM CARBONYL POWDERS
N. A. Belozerskii and L. D. Segal 13 Mar. 1973 9 p ref Transl. into ENGLISH from Poroshkovaya Met., Akad. Nauk Ukr. SSR (Kiev), v. 12, no. 7, Jul. 1972 p 1-4 In ENGLISH and RUSSIAN
(NLL-LTI-746-1418-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The characteristics of iron-nickel-molybdenum carbonyl

powders are discussed. The flow chart and apparatus for producing carbonyl iron-nickel powders are described. The chemical reactions involved in producing the alloy are reported. It is stated that articles with good magnetic properties were obtained from the carbonyl iron-nickel-molybdenum powder by compacting with subsequent heat treatment. Author

N73-25581 National Lending Library for Science and Technology, Boston Spa (England).
ESTIMATION OF SOLID PHASE OCCURRENCE DURING OXIDATION OF HEAVY METAL SULPHIDES
Eugen Pincovschi [1973] 27 p refs Transl. into ENGLISH from Studii Cercetari Met. (Bucharest), v. 10, no. 2, 1965 p 227-246
(NLL-M-22913-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A procedure for estimating the solid phase occurrence during the oxidation of heavy metal sulfides is presented. The method is based on registering concomitantly and continoüsly the weight and volume of the solid phase and gas phase with time. From these data equations are obtained which permit representation by means of phase diagrams. From the phase diagrams it is possible to find the phase composition at any moment in the development of the process. Author

N73-25582 National Lending Library for Science and Technology, Boston Spa (England).
THE MECHANISM OF VOLATILIZATION OF VANADIUM PENTOXIDE
V. P. Elyutin, Yu. A. Pavlov, V. P. Polyakov, and P. A. Nesterenko [1973] 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 9, 1972 p 5-7
(NLL-M-21570-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Based on mass spectrometer and chromatograph analyses of the vapor phase over V2O5 which forms during heating, and X-ray structural analysis of the solid residue, a proposition was made for the mechanism of V2O5(sol) volatilization. It was suggested that on annealing V2O5 in vacuo, its nonstoichiometricness to oxygen increases. As critical concentrations of oxygen vacancies are reached it is possible for an oxide phase to form with a lower oxygen content. Author

N73-25583 National Lending Library for Science and Technology, Boston Spa (England).
THE WETTING OF ZIRCONIUM NITRIDE WITH Ni-Co ALLOYS
Yu. A. Minaev, B. A. Iksanov, S. Z. Martynov, and O. Kh. Fatkullin [1973] 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 9, 1972 p 13-15 In ENGLISH and RUSSIAN
(NLL-M-21572-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

In attempt to determine the flow mechanism of molten alloys, the wetting and kinetics of zirconium nitride flow with nickel-cobalt alloys are studied. Results show that changes in limit angles with composition are due to the stability of adhesive films. It was also revealed that the spread of metal over nitride occurs by means of diffusion saturation of the film. Author

N73-25584 National Lending Library for Science and Technology, Boston Spa (England).
INFLUENCE OF HIGH TEMPERATURE HEATING ON PHASE PROPORTIONS IN O8Kh20N9G7T-STEEL
Z. Z. Kurmakaeva et al [1973] 9 p refs Transl. into ENGLISH from Stal (Moscow), no. 9, 1972 p 845-846 In ENGLISH and RUSSIAN
(NLL-M-21563-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The influence of heating at 1050 to 1250 C on the ductile properties and structure, after a 15 minute to 4 hour holding period, of O8Kh20N9G7T-steel is studied. Results show (1) Excessive temperature and holding time during heating of the steel results in an increase in the ferrite phase content and a reduction in the ductility of the steel during hot rolling. Hot tearing of the steel during rolling can be prevented only by strict adherence to a temperature range of 1000 to 1150 C for hot rolling and an appropriately calculated heating time. (2) The permissible residence times for ingots in the furnace tonnage and soak zones at high temperature should be determined experimentally in relation to ingot weight. (3) The titanium content of O8kh20N9G7T should be reduced to 0.6%. Embrittlement mechanisms of the steel are briefly discussed. Author

N73-25585 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF THE STRUCTURE AND PROPERTIES OF STAINLESS STEEL OKh20N7GT
I. Ya. Sokol [1973] 3 p Transl. into ENGLISH from Stal (Moscow), v. 9, 1972 p 857
(NLL-M-21566-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A study was made of the effect of heat treatment schedules on phase composition, structure, and properties of steel OKh20N7GT in connection with the assimilation of a technique for the production of welding wire. In the quenched state from 950 to 1000 C, the steel has a two phase austenite-ferrite structure with 25 to 30% delta ferrite, the quality of which increases to 45 to 50% when the heating temperature is raised to 1250 to 1280 C. Cold drawing results in a partial precipitation of metastable austenite, whereby after 50 to 60% reduction, 30 to 40% martensite may form. The cold deformed wire has good strength and plastic properties. Author

N73-25586 Arizona Univ., Tucson.
HELIUM POSITIONAL BEHAVIOR IN METAL MATRICES UNDER TEMPERATURE GRADIENTS Ph.D. Thesis
Manuel Francisco RodriguezPerazza 1972 49 p
Avail: Univ. Microfilms Order No. 72-30384

Helium migration behavior in an aluminum matrix was determined at temperatures from 472 K to 818 K with temperature gradients from 74 K/cm to 208 K/cm. Helium was observed to migrate from lower to higher temperatures by bubble transport controlled by surface diffusion. The aluminum matrix was charged with helium from the (n,alpha) reactions with boron-10 to introduce the helium into the material. Both the temperatures and the temperature gradients were monitored by temperature sensitive paint and by thermocouples. The migration distances and bubble sizes were measured by electron microscopy techniques using the Hitachi HU-200 microscope. Migration velocities ranged from 220 A/sec for bubbles of 200 A radius under a temperature gradient of 91 K/cm at 508 K to 3500 A/sec for bubbles of 2200 A in radium under a temperature gradient of 208 K/cm at 758 K. The experimental diffusion coefficients were found to be independent of crystal orientation or temperature gradient. Dissert. Abstr.

N73-25587 Stanford Univ., Calif.
STRESS WAVES IN CONDUCTORS INDUCED BY RELATIVISTIC ELECTRON BEAMS Ph.D. Thesis
Bernard John Richter 1972 120 p
Avail: Univ. Microfilms Order No. 72-30686

The prediction of additional stress waves which were overlooked in previous theoretical investigations are dealt with. These, when added to those thermal stress waves created by the previously described heating effect of the electron cloud, can account for some of the discrepancy between the theoretical and experimental results. These additional stress waves are induced in the metallic target by time-dependent surface tractions created by the electromagnetic field of the approaching electron beam. The problem of finding the induced stress waves is solved in three steps. First, the electromagnetic field is found by solving Maxwell's equations inside the chamber for a given cloud of charge. Second, the tractions on the target surface are related to the jump in the electric and magnetic fields across the target surface. Third, these surface tractions then are utilized as boundary conditions in conjunction with equations governing one-dimensional stress wave propagation in linear elastic homogeneous media. Dissert. Abstr.

N73-25588 Florida State Univ., Tallahassee.
A DYNAMIC METHOD FOR MEASURING THE STRESSES GENERATED DURING THE HIGH TEMPERATURE OXIDATION OF METALS AND ALLOYS Ph.D. Thesis
Nikolaos Tsangarakis 1972 101 p
Avail: Univ. Microfilms Order No. 72-27937

A new method, based on a series of creep tests, was used to determine the stresses generated during the high temperature oxidction of copper and nickel. The measured stresses were found to be not high enough so as to cause breakaway in the oxidation of both copper and nickel. In the case of copper the stresses were due to differential oxidation, epitaxy, and grain boundary penetration. In the case of nickel epitaxy and differential oxidation were found to be the main mechanisms giving rise to oxidation stresses. Dissert. Abstr.

N73-25589 Minnesota Univ., Minneapolis.
STRENGTHENING MECHANISMS IN NICKEL-BASE SUPERALLOYS Ph.D. Thesis
LeRoy Roger Curwick 1972 178 p
Avail: Univ. Microfilms Order No. 72-27852

The elastic moduli and the compressive yield behavior was measured for Ni3 (Al,X) alloy single crystals containing Nb, Ta, Ti, W, or Mo, and for Ni-Cr-X alloy single crystals containing Co, W, or Mo. From these results the critical resolved shear stress for slip was determined over the temperature range from 25 to 1000 C. The Ni3 (Al,X) yield behavior was interpreted on the basis of slip on two slip systems, /111/<110> and /100/<110>. A modified exhaustion hardening model is proposed to account for the anomalous temperature dependence of the critical resolved shear stress for /111/<110> slip in these alloys. The effects of alloying on the /111/<110> CRSS and on the /100/<110> CRSS are consistent with the proposed model. The Ni-Cr-X yield behavior was interpreted on the basis of normal FCC lattice slip on the /111/<110> slip system. The effects of alloying on the /111/<110> CRSS are consistent with classical solid solution strengthening. Dissert. Abstr.

N73-25590 Oregon State Univ., Corvallis.
CREEP OF TUNGSTEN DISPERSION STRENGTHENED BY ZrO2 Ph.D. Thesis
Robert Blickensderfer 1972 94 p
Avail: Univ. Microfilms Order No. 72-27621

Tungsten alloys containing approximately 0.75 and 2.3 vol pct ZrO2 were prepared by powder metallurgical methods from blends of commercial tungsten powder and ZrW2 powder. A heat treatment of the extruded rods at 1800 C was found to produce a stable structure with a dispersion of ZrO2 particles in the tungsten matrix. There was essentially no difference in microstructure between the two alloys except the 2.3 vol pct ZrO2 alloy contained more of the coarse ZrO2 stringers. The tensile strength of the alloys ranged from 45 ksi at 1500 C to 25 ksi at 2000 C. Stress rupture lives were determined at 1375 C and 1740 C over a stress range of 10 to 60 ksi. Creep measurements were made over the temperature range of 1485 to 1924 C and over a stress range of 3.5 to 20 ksi. The creep behavior of these tungsten alloys fits the functional relationships of stress and temperature given by the Ansell-Weertman model for dispersion strengthened alloys at both low and high stresses. Dissert. Abstr.

N73-25591 Michigan State Univ., East Lansing.
A STUDY OF THE STRENGTH OF TUNGSTEN CARBIDE-COBALT ALLOYS FROM A FRACTURE MECHANICS VIEWPOINT Ph.D. Thesis
Roy Carl Lueth 1972 164 p
Avail: Univ. Microfilms Order No. 72-29996

The critical strain energy release rate and stress intensity parameter were determined for nine tungsten carbide-cobalt alloys by a wedge loaded double cantilever beam test. The nine alloys studied had uniform average grain sizes ranging from 3 to 15 wt. percent. The implications of these data were discussed as they affect the theories of strength of cemented carbides. The critical strain energy release rate depends on the energy absorbed in the area adjacent to the tip of a metastable crack in the material. The energy absorbed at the tip of the crack depends on the amount of plastic work done on the binder contained in the plastic yield zone, as no flow was detected in the tungsten carbide particles. The amount of plastic work done on the binder in the yield zone is dependent on the volume of binder which plastically flows, which in turn is dependent on the binder film thickness, and the number of grains (and binder films) the plastic zone includes. Dissert. Abstr.

N73-25592 Washington Univ., St. Louis, Mo.
MOSSBAUER EXPERIMENTS IN IRON-NICKEL ALLOYS AT HIGH PRESSURES Ph.D. Thesis
David Richard Rhiger 1972 182 p
Avail: Univ. Microfilms Order No. 72-28653

Iron-nickel alloys in the invar range have been studied with the Mossbauer effect at high pressures for the first time. Invar has about 29 to 45 at. % Ni. The principal result of this study is the discovery of a new phase, most probably antiferromagnetic, in invar at high pressures and low temperatures. For Fe-30 at. % Ni the antiferromagnetic phase appears at pressures above 70 kbar. Its Neel temperature TN has a slope of +1.9 + or - 0.3 K/kbar and a zero-pressure intercept of -41 + or - 21 K. Evidence for this phase is a broadening of the Mossbauer resonance line, attributed to an unresolved magnetic splitting, and distinct transitions seen in Mossbauer thermal scans. Dissert. Abstr.

N73-25593 Delaware Univ., Newark.
THE ELECTRONIC WORK FUNCTION OF COPPER-NICKEL ALLOYS Ph.D. Thesis
Richard Stanley Nietubicz 1972 151 p
Avail: Univ. Microfilms Order No. 72-32011

The work functions of copper and several copper-nickel single crystals of the (211) orientation have been measured using the Sheldon method, in a vacuum, at pressures of less than 10 to the minus 10th power torr and at room temperature. The work function, and the thermionic emission constant, for each specimen was found. The observed variation in the work function with composition was attributed to the existence of a two-phase region within the first few monolayers of the surface which formed during initial vacuum processing of the experimental system. This two-phase region was estimated to extend in the range of composition from nearly 80 at. percent copper to nearly pure nickel. The copper-rich phase was estimated to have a work function of 4.39 ev and the nickel-rich phase a work function of 4.30 ev. Dissert. Abstr.

N73-25594 Arizona Univ., Tucson.
PROPERTIES OF UNIDIRECTIONALLY SOLIDIFIED ALLOYS Ph.D. Thesis
Edward Benn 1972 123 p
Avail: Univ. Microfilms Order No. 72-31856

The properties of unidirectionally solidified (UDS) aluminum alloys were investigated metallographically, mechanically and dimensionally. Three distinct structures were obtained and tested: (1) random polycrystals, (2) columnar crystals, and (3) growth twin or feather crystals. In two-phase alloys, samples containing columnar and feather crystals showed a marked increase in mechanical properties over randomly structured samples in the as-cast condition. Experiments were performed to determine the nature and conditions of nucleation for feather crystals. The effects of increasing solute content in unidirectionally cast Al-Cu alloys were observed. It was also observed that feather crystals only occur over a limited range of solute concentration. Several commercial aluminum casting alloys were investigated for use as substrates for optical mirrors. Dissert. Abstr.

N73-25595 Wisconsin Univ., Madison.
THE FATIGUE OF NICKEL PLATED COPPER Ph.D. Thesis
Edwin Albert McKinnon 1972 78 p
Avail: Univ. Microfilms Order No. 72-23750

Oxygen-free-high-conductivity copper specimens were tested using load control. The specimens were sinusoidally loaded in axial push pull. Life tests for unplated specimens were obtained over the stress range of plus or minus 11,500 psi (N sub f = 6,705,000 cycles) to plus or minus 15,200 psi (N sub f = 246,000 cycles). The mechanism of life extension by the application of electroplated layers of nickel was investigated. It was shown that the rate of crack initiation in the copper was retarded by a coating of nickel from a leveling plating solution. The influence of coating thickness on fatigue life was studied. Thicknesses of 0.0001 inches to 0.0005 inches were used with a maximum life extension of 450 percent with a 0.00025 inch thick coating. Life extensions were obtained by switching the plating current on and off during plating thus creating interfaces in the coating. Dissert. Abstr.

N73-25596*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALLOY COMPOSITION EFFECTS ON OXIDATION PRODUCTS OF VIA, B-1900, 713C, AND 738X: A HIGH TEMPERATURE DIFFRACTOMETER STUDY
Ralph G. Garlick and Carl Lowell Washington Jun. 1973 24 p refs
(NASA-TM-X-2796; E-7318) Avail: NTIS HC $3.00 CSCL 11F

High temperature X-ray diffraction studies were performed to investigate isothermal and cyclic oxidation at 1000 and 1100 C of the nickel-base superalloys VIA, B-1900, 713C, and 738X. Oxidation was complex. The major oxides, Al_2O_3, Cr_2O_3, and the spinels, formed in amounts consistent with alloy chemistry. The alloys VIA and B-1900 (high Al, low Cr alloys) tended to form Al_2O_3 and $NiAl_2O_4$; 738X (high Cr, low Al) formed Cr_2O_3 and $NiCr_2O_4$. A $NiTa_2O_6$ type of oxide formed in amounts approximately proportional to the refractory metal content of the alloy. One of the effects of cycling was to increase the amount of spinels formed. Author

N73-25597*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TENSILE PROPERTIES TO 650 C AND DEFORMATION STRUCTURES IN A PRECIPITATION STRENGTHENED TITANIUM-ALUMINUM ALLOY
Madan G. Mendiratta Washington Jun. 1973 24 p refs
(NASA-TN-D-7325; E-7367) Avail: NTIS HC $3.00 CSCL 11F

Appreciable strength levels were retained to 650 C in a Ti-10Al-1Si alloy aged in the (alpha + alpha sub 2) phase field to yield optimum room temperature strength and ductility. The aging treatment precipitated a uniform distribution of alpha sub 2-particles such that, at room temperature, dislocations bypassed instead of shearing the particles at low strains. Specimens fractured at room temperature exhibited fine uniform dimples even for those aging conditions that imparted no macroscopic ductility. The main crack appeared to propagate through the planar slip bands that had cut through the alpha sub 2-particles. A two-step aging process produced a higher volume fraction of bimodally distributed alpha sub 2-particles that led to higher strength levels at elevated temperatures. Both for the single size and the bimodal alpha sub 2-particle distributions, elevated-temperature deformation structures consisted mainly of planar slip bands that sheared through the alpha sub 2-particles. Author

N73-25598*# National Aeronautics and Space Administration, Washington, D.C.
METALLURGY: A COMPILATION
1973 28 p refs
(NASA-SP-5940(03)) Avail: NTIS HC $1.00 CSCL 11F

A technology utilization program is presented for the dissemination of information on technological developments which have potential utility outside the aerospace and nuclear communities. Discussion is restricted to the effects of hydrogen on a variety of metal alloys, and the mechanical properties of some recently developed alloys. Hydrogen at both low and high pressure is shown to have adverse effects on alloys such as ultrahigh-strength steels, irradiated steels, columbium, inconel alloys, titanium alloys, and certain stainless steels. The mechanical and physical properties of a wide range of alloys, their performance at elevated temperatures, and some of the processes involved in their development are also considered. Author

N73-25599# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Solid State Sciences Lab.
ABSOLUTE YIELDS OF X-RAY INDUCED PHOTOEMISSION FROM METALS Interim Report
John N. Bradford 23 Aug. 1972 30 p refs
(AF Proj. 5621; AF Proj. 5710)
(AD-750875; AFCRL-72-0542; PSRP-510) Avail: NTIS HC $3.50 CSCL 20C

Absolute electron yields from tantalum, molybdenum, copper and aluminum were measured for several bombarding geometries. The photon spectra used were derived from filtered bremsstrahlung generated in a tungsten anode at 50 kV, constant potential. The electron spectra were measured by a cylindrical electrostatic analyzer with a secondary emission detector. The spectra exhibit both Auger and scattered photoelectrons. The electron current densities arising from these spectra constitute source functions for vulnerability studies on systems exposed to internal electromagnetic pulse (IEMP) effects arising from nuclear environments. Author

N73-25600*# Rensselaer Polytechnic Inst., Troy, N.Y.
THE ROLE OF PROCESS HISTORY, PHASE MORPHOLOGY AND INTERFACE STRENGTH UPON THE MECHANICAL PROPERTIES OF DISPERSION STRENGTHENED ALLOYS
George S. Ansell Dec. 1972 58 p refs
(Contract NAS8-26007)
(NASA-CR-124274) Avail: NTIS HC $5.00 CSCL 11F

An analytical rationale for the sensitivity-insensitivity of dispersion-strengthened systems to process history is provided. In particular, the research was focussed upon the influence of the particle-matrix interface bond in TD-Nickel and TD-Nichrome, and the manner in which the differences in both elastic constants and thermal expansion coefficients between these phases stress this interface when these alloys are subjected to mechanical and thermal loads upon the mechanical properties of these alloys. Author

N73-25601*# Martin Marietta Aluminum, Inc., Torrance, Calif.
MONOLAYER BORON-ALUMINUM COMPACTED SHEET MATERIAL Final Report
E. V. Sumner Jan. 1973 173 p refs
(Contract NAS8-27626)
(NASA-CR-124278; HA-2559) Avail: NTIS HC $10.75 CSCL 11F

The manufacturing techniques, basic materials used, and equipment required to produce monolayer boron-aluminum composites are described. Tentative materials and process specifications are included. Improvements in bonding and filament spacing obtained through use of brazing powder in the fugitive binder are discussed. Author

N73-25602# Battelle Columbus Labs., Ohio.
VOLUMETRIC EXPANSION OF SILVER ALLOY
J. W. Droege 3 Nov. 1972 5 p Sponsored by AEC
(TID-26251) Avail: NTIS

Results of measurements of density and linear expansion of Ag-15% In-5% Cd rods at room temperature to the melting range are presented. Data are presented graphically and discussed. NSA

N73-25603# Bettis Atomic Power Lab., Pittsburgh, Pa.
MICROSTRUCTURAL OBSERVATIONS ON NICKEL-CHROMIUM-IRON ALLOY 718 (LWBR DEVELOPMENT PROGRAM)
R. J. Towner Jan. 1973 77 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-1077) Avail: NTIS

Characteristic microstructures of sheet, wire, and bar are presented, as influenced by material processing conditions and as revealed by various metallographic techniques. The conditions and techniques described result from development work on NiCrFe Alloy 718. The amount of niobium carbide precipitate at grain boundaries after aging appeared to be strongly influenced by solution annealing temperature and relatively small differences in chemical composition. Fine precipitate was observed at grain boundaries after 1860 F braze/heat treatment. During the 1800 to 1860 F solution anneals, recrystallization and/or grain growth moved the grain boundaries from prior carbide networks. Author (NSA)

N73-25604# California Univ., Berkeley. Lawrence Berkeley Lab.
HARPER-DORN CREEP OF METALS AT HIGH TEMPERATURES
F. A. Mohamed, K. L. Murty, and J. W. Morris, Jr. Sep. 1972 23 p refs Presented at John E. Dorn Memorial Symp., Cleveland, 16 Oct. 1972
(Contract W-7405-eng-48)
(LBL-1158; Conf-721064-1) Avail: NTIS

A report is presented on the current status of research on Harper-Dorn creep: a type of viscous deformation found in

some metals and alloys at high temperature and low stress. The creep is characterized by a strain rate which is linearly dependent on applied stress, apparently independent of grain size, and several orders of magnitude above the strain rate obtainable from diffusional processes in large grained samples. The experimental evidence supporting Harper-Dorn creep in pure aluminum is summarized, along with data indicating the occurance of Harper-Dorn creep in other materials. Available microstructural evidence on the mechanism of Harper-Dorn creep is reviewed: this type of creep is apparently due to the motion of dislocations. While the details of the process are unknown, available data may be plausibly interpreted as due to climb of saturated dislocations. Simple Harper-Dorn creep behavior disappears when the applied stress exceeds a critical value or when sample grain size becomes sufficiently small. Author

N73-25605# California Univ., Livermore. Lawrence Livermore Lab.

ELECTRICAL CONDUCTIVITY OF LIQUID ALUMINUM

M. Ross 4 Jan. 1973 7 p refs

(Contract W-7405-eng-48)

(UCRL-51322) Avail: NTIS

The electrical conductivity of liquid aluminum was calculated from a model based on the theory of Ziman. The scattering cross sections are calculated using the hard-sphere structure factor for determining the atomic arrangements and a pseudopotential for the electron-ion interaction. Calculations extend from the melting point to the critical point. Author (NSA)

N73-25606# Hanford Engineering Development Lab., Richland, Wash.

EFFECTS OF RADIATION ON STRUCTURAL MATERIALS. DUCTILITY LIMITATIONS OF IRRADIATED TYPE 316 STAINLESS STEEL

J. J. Holmes, A. J. Lovell, and R. L. Fish Jun. 1972 30 p refs Presented at Symp. on the Effects of Radiation on Structural Mater., Los Angeles, 26 Jun. 1972

(Contract AT(45-1)-2170)

(HEDL-SA-310; Conf-720604-5) Avail: NTIS

The effect of fast reactor irradiation on the ductility of annealed AISI Type 316 stainless steel is described in terms of strain rate, temperature, and neutron fluence. While considerable irradiation effects data have been reported previously, the detailed ductility fluence relationships required to perform steady-state, transient, and safety analyses are not yet available in the literature. To fulfill this need, creep and tension data obtained after EBR-2 irradiations are presented and analyzed in terms of controlling deformation mechanisms. The basic nature of each deformation process is used to infer ductility-loss trends and to define the environmental conditions where specific ductility-fluence relationships apply. The resulting correlation quantitatively describes ductility at fluences approaching 1 x 10 to the 23rd power/sq cm, strain rates from 10 to the minus 8th power to 10 to the 4th power/h, and temperatures from 370 to 760 C. Author (NSA)

N73-25607# Hanford Engineering Development Lab., Richland, Wash.

TENSILE AND CREEP BEHAVIOR OF COLD WORKED TYPE 316 STAINLESS STEEL AFTER EBR-2 IRRADIATION

R. L. Fish, A. J. Lovell, H. R. Brager, and J. J. Holmes Nov. 1972 21 p refs Presented at BNES Conf. on Irradiation Embrittlement and Creep in Fuel Cladding and Core Components, London, 9-10 Nov. 1972

(Contract AT(45-1)-2170)

(HEDL-SA-468; Conf-721115-3) Avail: NTIS

The effects of fast reactor irradiation on post irradiation tensile and creep properties of 20% cold-worked Type 316 stainless steel were investigated. Little effect of irradiation on tensile properties was found at test temperatures equal to or less than 540 C. Transmission electron microscopy revealed that some dislocation loop formation occurred at low irradiation temperatures, but this was insufficient to cause irradiation hardening. At test temperatures in excess of 650 C, helium embrittlement caused a marked decrease in tensile ductility. Irradiation increased creep rates but either decreased or did not affect creep ductility, depending on test and irradiation conditions. In all cases, reduced rupture times were found. Author (NSA)

N73-25608# Watervliet Arsenal, N.Y.

EFFECT OF CARBONACEOUS GAS ENVIRONMENT ON THE CORROSION OF AISI-4330 HIGH STRENGTH STEEL

Fumihiko Saegusa Jan. 1973 39 p refs

(DA Proj. 1T0-62105-A-328)

(AD-758848; WVT-7302; R-WV-T-X-2-73) Avail: NTIS CSCL 11/6

Corrosion of high strength steel in gaseous environment is largely divided in two areas, high temperature oxidation and stress corrosion cracking at lower temperatures. High temperature oxidation of the 4330 steel was conducted in CO-CO2 mixtures up to 1300C. The reaction includes decarburization, internal and external oxidation depending on the composition of the gas mixture and temperature. Cracks were observed after the stage of internal oxidation. Stress corrosion test revealed that the 4330 is susceptible to stress corrosion cracking in CO-CO2 in the presence of moisture. The cracking is transgranular and appears to involve hydrogen embrittlement at the crack tip.

Author (GRA)

N73-25609# British Steel Corp., London (England). Metallurgy Dept.

PROCEDURES USED BY MEMBERS OF THE STUDY GROUP FOR THE ANALYSIS OF STEEL AND RELATED MATERIALS

G. D. Hall and P. H. Scholes Oct. 1972 20 p Supersedes MG/CCD/504/72

(PB-214230/5; MG/CCD/537/72; MG/CCD/504/72) Avail: NTIS HC $3.00 CSCL 07D

Brief details of atomic absorption procedures used by members of the Study Group are presented in tabular form in this report. About 200 procedures are listed covering the determination of 26 elements; one third of the procedures deal with the analysis of iron and steel, and the remainder are mainly concerned with the analysis of nonmetallic materials. Procedures are also listed for the analysis of a wide variety of other materials associated with the manufacture of iron, steel, and nickel-base alloys; these include lubricating oils, polluted waters, nonferrous alloys, urine, coatings, canned beverages, plating solutions, etc. Author

N73-25610# Tyco Labs., Inc., Waltham, Mass.

DEVELOPMENT OF LOW COST, CORROSION RESISTANT ALLOYS AND OF ELECTROCHEMICAL TECHNIQUES FOR THEIR PROTECTION IN DESALINATION SYSTEMS

F. H. Cocks, A. H. Taylor, S. B. Brummer, J. W. OMeara, W. Sherman Gillam, and Francis H. Coley Dec. 1972 243 p refs

(Contract DI-14-01-0001-1730)

(PB-215265/0; OSW-RDPR-72-801) Avail: NTIS HC $6.75 CSCL 11F

A corrosion - resistant alloy of the Cu-Zn-Ni-Al family was developed for desalination systems. Modified by the addition of Fe and Mn, the alloys can be fabricated soft and thermally treated to impart a yeild strength in excess of 140,000 psi. In a 268 F saline solution an improvement in corrosion resistance over arsenical aluminum brass by a factor of three was noted. Also studied were means to protect the alloy, and others commercially available, by anodic protection techniques.

Author (GRA)

N73-25611# British Steel Corp., London (England). Metallurgy Dept.

THE ANALYSIS OF HIGH ALLOY STEELS BY X-RAY FLUORESCENCE USING A CORRECTION FACTOR TECHNIQUE

W. Johnson Oct. 1972 5 p

(PB-214231/3; MG/D/441/70-Add) Avail: NTIS HC $3.00 CSCL 11F

In report MG/D/441/70 an apparent discrepancy between X-ray and chemical figures in the standardization of tungsten was not satisfactorily explained. A combination of additional X-ray work and chemical re-standardization, shows that a discrepancy does not, in fact, exist. Author (GRA)

N73-25612# British Steel Corp., London (England). Metallurgy Dept.

THE DETERMINATION OF BISMUTH IN HIGH ALLOY STEELS

R. F. Staham Oct. 1972 7 p Supersedes MG/CC/527/71

(PB-214234/7; MG/CC/567/72; MG/CC/527/71) Avail: NTIS HC $3.00 CSCL 11F .

Results for the determination of bismuth on four samples of type 310 stainless steel by two photometric chemical procedures, two atomic absorption procedures and by a square wave polarographic method showed satisfactory reproducibility on all samples. It was also shown that it should be possible to determine bismuth at low levels in samples of similar composition by a photographic spectrographic procedure, provided that sufficient samples of the same composition, with known bismuth contents, are available. Author (GRA)

N73-25613# Reynolds Metals Co., Richmond, Va. Metallurgical Research Div.

HIGH STRENGTH ALUMINUM ALLOY DEVELOPMENT Final Report, 1 Jun. 1971 - 30 Nov. 1972

D. S. Thompson Wright-Patterson AFB, Ohio AFML Apr. 1973 57 p refs

(Contract F33615-69-C-1643; AF Proj. 7351)

(AD-759557; AFML-TR-73-18) Avail: NTIS CSCL 11/06

RX720 alloy, nominally 6.75% Zn, 2.5% Mg, 1.2% Cu and 0.12%Zr, has been evaluated in the form of 3 inch plate and 8 inch x 9 inch cross section hand forgings. Commercial plants were used for both the rolling and forging of the laboratory cast ingots. After various aging practices were evaluated in terms of strength and electrical conductivity, a few were chosen for the final evaluation. These materials were then evaluated and compared to the minimum goals of K sub (1c) = 35 sq root of ksi in, a 25 ksi stress corrosion threshold for the short transverse direction and a fatigue strength equivalent or superior to 7075-T6. These goals were to be achieved at yield strengths of 72 ksi for 3 inch plate and 63 ksi for an 8 inch forging. (Author Modified Abstract) GRA

N73-25614# RMI Co., Niles, Ohio. Research and Development Dept.

DEVELOPMENT OF A 900 F TITANIUM ALLOY Final Report, May 1971 - Sep. 1972

George J. Hall, Stanley R. Seagle, and Howard B. Bomberger Apr. 1973 128 p refs

(Contract F33615-71-C-1551; AF Proj. 7351)

(AD-759215; AFML-TR-73-37) Avail: NTIS CSCL 11/6

The goal was to achieve an improved combination of elevated temperature properties, particularly high elevated temperature tensile strength. The alloy Ti-5Al-5Sn-2Zr-4Mo-0.25Si comes close to meeting the objectives of the contract. This alloy has the capability of achieving 120 ksi 900 F yield strength and high creep strength. At a creep exposure of 1000 F and 55 ksi for 96 hours the alloy has a permanent deformation of -0.23 percent. It also shows good stability as determined by post-creep ductility. Additional thermo-mechanical treatments show promise for improving the high-temperature properties further. Various alloying elements were studied in the investigation. (Author Modified Abstract) GRA

N73-25615# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.

ENVIRONMENT ENHANCED FATIGUE CRACK GROWTH IN HIGH-STRENGTH STEELS

R. P. Wei and G. W. Simmons Mar. 1973 62 p refs

(Contract N00014-67-A-0370-0008; NR Proj. 036-097)

(AD-759088; IFSM-73-39; TR-1) Avail: NTIS CSCL 11/6

The current state of understanding of the phenomenology and mechanisms for corrosion fatigue of high-strength steels is reviewed. Particular attention is directed towards corrosion fatigue in hydrogen and in water/water vapor environments. Available experimental data indicate that fatigue crack growth in high-strength steels is influenced by loading variables, such as frequency, stress ratio and waveform in regions above and below KIscc. The influences of these variables are directly attributed to interactions with the external chemical environment. Possible synergistic interactions and their relation to chemical reaction kinetics are indicated. Pertinent information on oxygen-metal and water-metal reactions is summarized. Initial results from a coordinated program of study for determining the water-metal reaction kinetics and the kinetics of crack growth on a single high-strength steel are discussed. (Author Modified Abstract) GRA

N73-25616# Virginia Polytechnic Inst. and State Univ., Blacksburg. Div. of Minerals Engineering.

X-RAY DIFFRACTION INVESTIGATIONS OF ATOMIC ARRANGEMENTS ABOUT THE DIFFUSION ZONES IN Cu-Ni AND Cu-Ag ALLOYS Final Report, 1 Sep. 1965 - 1 Jan. 1973

C. R. Houska Apr. 1973 9 p refs

(Grants DA-ARO(D)-31-124-G709; DA-ARO(D)-31-124-G1046; DA-ARO(D)-31-124-G145)

(AD-759195; AROD-5671-7-MC) Avail: NTIS CSCL 11/6

Development and application of X-ray techniques for examining diffusion zones are described. Study of diffusion damage to a specimen containing an electrodeposit of Ni on a copper single crystal is reported. Author (GRA)

N73-25617# Battelle Columbus Labs., Ohio. Metals and Ceramics Information Center.

FRACTURE ANALYSIS BY SCANNING ELECTRON MICROSCOPY

James L. McCall Dec. 1972 22 p refs

(Contract DSA900-73-C-0922)

(AD-759287; MCIC-72-12) Avail: NTIS CSCL 11/6

The use of the scanning electron microscope (SEM) in the study and analysis of fractures in materials is evaluated and discussed in this report. The principles of operation of the SEM are outlined, and auxiliary techniques available for use in conjunction with the SEM, such as dispersive X-ray spectrometry, X-ray energy analysis and Auger electron spectroscopy, are pointed out and discussed. The advantages offered by use of the SEM for studying fractures are examined critically. A brief survey of electron fractography in general is followed by description, with a number of illustrative photomicrographs, of examples in which the SEM was used specifically to study fractures. The final section of the report is an extensive review of the SEM fractography literature, citing 156 references. Author (GRA)

N73-25618# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

EFFECT OF THERMOMECHANICAL TREATMENT ON THE STRESS CORROSION CRACKING BEHAVIOR OF BETA 3 TITANIUM

Dale O. Condit and John H. Seats Feb. 1973 17 p refs

(AF Proj. 7021)

(AD-759166; ARL-73-0017) Avail: NTIS CSCL 11/6

The effect of thermomechanical treatment on the stress corrosion cracking susceptibility of Beta III (Ti-11.5Mo-6Zr-4.5Sn) alloy was investigated. Specimens of the alloy were cold worked 0, 2, 5, 10, 20, and 50% and precipitation hardened prior to fabrication into tensile test specimens. Five specimens of each thermomechanical treatment condition were tensile tested in order to obtain yield strengths. The remaining specimens were exposed to an alternate wet/dry environment of 3.5 w/o NaCl solution at ambient temperature under a load of 80% of yield. (Author Modified Abstract) GRA

N73-25619# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

METHODS FOR INCREASING STRENGTH CHARACTERISTICS OF HEAT-RESISTANT AND HIGH-STRENGTH CAST ALUMINUM ALLOYS

I. F. Kolovnev 12 Apr. 1973 14 p refs Transl. into ENGLISH from the monograph "Splavy Tsvetnykh Metallov" USSR, 1972 p 205-210

(AD-759645; FTD-HT-23-158-73) Avail: NTIS CSCL 11/6

The report discusses heat-resistant, high-strength, and vacuum-tight cast aluminum alloys, with properties 2-3 times higher than those of standard alloys of the type AL1, AL2, AL4, AL5, AL7, and AL9. GRA

N73-25620# Naval Research Lab., Washington, D.C.

DUCTILE FRACTURE EQUATION FOR HIGH STRENGTH STRUCTURAL METALS Final Report

R. W. Judy, Jr. and R. J. Goode 3 Apr. 1973 23 p refs

(NRL Proj. M01-24; NRL Proj. M01-30; RR0020146; ZF54544002)

(AD-759351; NRL-7557) Avail: NTIS CSCL 11/6

Dynamic Tear (DT) test R-curves were developed to define the inherent resistance of structural materials to fracture in terms

of the energy-per-unit extension required to cause rapid crack extension. Translation of the R-curve characterizations to useful form for design of structures to preclude fracture has been accomplished by the use of Ratio Analysis Diagram (RAD). R-curve concepts and RADs have been established for steels, aluminum alloys, and titanium alloys. (Author Modified Abstract) GRA

N73-25621# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF PRELIMINARY HEAT TREATMENTS ON THE CORROSION OF TITANIUM ALLOY TVO
O. M. Shapovalova, L. P. Kurilekh, and E. L. Kamenshchik 12 Apr. 1973 17 p refs Transl. into ENGLISH from Sb. Tr. Met. Khim. Titana (USSR), no. 5, 1970 p 90-99
(AD-759626; FTD-MT-24-1712-72) Avail: NTIS CSCL 11/6
The report gives the results of investigation of the effect of quenching on the corrosion of secondary titanium alloy (TVO). GRA

N73-25622# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESEARCH OF PROPERTIES OF ALLOY TB2 TITANIUM
O. M. Shapovalova, Y. K. Molchahova, and L. K. Mineyeva 13 Apr. 1973 15 p Transl. into ENGLISH from Sb. Tr. Met. Khim. Titana (USSR), no. 6, 1970 p 117-122
(AD-759621; FTD-HT-23-1713-72) Avail: NTIS CSCL 11/6
Experiments determined that the titanium alloy TB2 can be used not only as a high-strength and heat-resistant alloy, but at the same time as a corrosion-resistant alloy in various hostile media. GRA

N73-25623# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METASTABLE BETA ALLOYS OF TITANIUM
N. V. Ageev and L. A. Petrova 3 Apr. 1973 13 p refs Transl. into ENGLISH from the book "Splavy Tsvetn. Metallov" 1972 p 175-179
(AD-759387; FTD-HT-23-154-73) Avail: NTIS CSCL 11/6
The alloys were studied by the methods of metallographic and X-ray phase analysis and by measurement of hardness and testing of mechanical properties under tension. GRA

N73-25624# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF CERTAIN ASPECTS OF THE METHOD OF DIRECTIONAL CRYSTALLIZATION
D. A. Petrov 21 Mar. 1973 15 p refs Transl. into ENGLISH from the book "Splavy Tsvetn. Metallov" 1972 p 76-81
(AD-759422; FTD-HT-23-151-73) Avail: NTIS CSCL 11/6
Presently turbine blade alloys are cast in such a way as to remove transverse grain boundaries. The author studied this directional crystallization of cast metals from the point of crystal growth and nucleation. GRA

N73-25625# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MECHANICAL PROPERTIES OF ALUMINUM-LITHIUM ALLOY
M. E. Drits, E. S. Kadaner, N. I. Turkina, and S. G. Fedotov 3 Apr. 1973 14 p refs Transl. into ENGLISH from the book "Splavy Tsvetn. Metallov" 1972 p 187-192
(AD-759423; FTD-HT-23-155-73) Avail: NTIS CSCL 11/6
A study was made of the elastic and mechanical properties of alloys of the aluminum lithium system enriched with aluminum. The alloy of aluminum with 3-4% Li, possessing high values of Young's modulus, tensile strength, and yield point together with satisfactory ductility and corrosion resistance, may be of greatest practical interest. Alloys containing more than 3% Li should have a major advantage in operation under compression. The use of alloys with a high lithium content is limited by the reduced corrosion resistance and increased brittleness caused by the presence of a large quantity of the brittle and chemically active compound Li Al. GRA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-25626 National Lending Library for Science and Technology, Boston Spa (England).
THE INFLUENCE OF TITANIUM IONS ON THE MAGNETIC PROPERTIES OF MANGANESE-ZINC FERRITES
I. Hanke 9 Apr. 1973 13 p refs Transl. into ENGLISH from Ber. Deut. Keram. Ges. (Bonn), v. 49, no. 9, 1972 p 295-300 (NLL-Trans-862-(9022.64)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon
The influence of titanium ions on the magnetic properties of manganese-zinc ferrites is discussed. The nature of the chemical reactions involved in the production of ferrites is reported. The following subjects are included: (1) permeability versus temperature curves, (2) Curie temperature and the position of the spin moment zero, (3) temperature dependence of the losses, (4) electron diffusion aftereffect, and (5) temperature dependence of the resistivity and the relaxation time. Author

N73-25627 National Lending Library for Science and Technology, Boston Spa (England).
SILICON NITRIDE-ALUMINA SYSTEM SINTERED MATERIALS
Y. Oyama and O. Kamigaito Apr. 1973 28 p refs Transl. into ENGLISH from Yogyo Kyokai Shi (Tokyo), v. 80, no. 924, 1972 p 29-38 (327-336)
(NLL-RTS-7988) Avail: Natl. Lending Library, Boston Spa, Engl.: £2.70; 9 NLL photocopy coupons
The characteristics of silicon nitride-alumina system sintered materials are discussed. Experiments were conducted in which the oxidation resistance of the alumina additive in the sintered silicon nitride was analyzed. The chemical reactions and the processes used to produce the sintered material are described. Tables of data and graphs are included to present the physical and mechanical properties of the material. Author

N73-25628 National Lending Library for Science and Technology, Boston Spa (England).
THE NATURE OF POLYMER FRICTION
I. V. Kragelskii 12 Mar. 1973 23 p refs Transl. into ENGLISH from Mekh. Polim. (USSR), v. 5, 1972 p 797-808 Presented at 2d All-Union Conf. on Polymer Mech., Riga, Nov. 1971
(NLL-Risley-Tr-2577-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons
The evolution of theories concerning the nature of polymer friction since 1940 is outlined, based on the work of Kragel'skii, Thirion, Tabor, King, Tanaka Kynichiro, and Schallamach, a detailed analysis is made of Bartenev's molecular-kinetic theory of friction and a report is given of the results obtained by scientists in this field. Work on mechanochemical changes occurring during friction contact is reported. Formulae are derived for calculating the mechanical component and the molecular component of the friction force. Ideas based on the work of Frenkel, and also Glasstone, Eyring and Polyani, are presented to explain the molecular component. Author

N73-25629 New Mexico Univ., Albuquerque.
THE ZIRCONIA-YTTRIA SYSTEM ABOVE 2000 C Ph.D. Thesis
Samuel Robert Skaggs 1972 136 p
Avail: Univ. Microfilms Order No. 72-30736
The use of a CO2 laser as a heating source to study the ZrO2-Y2O3 system above 2000 C without using a container is reported. Two hundred and fifty four spherules from 2 to 2.5 mm in diameter were fused from premixed powder pellets. The 2 to 2.5 mm diameter spherules were divided. One part was examined by X-ray diffraction using the 114.6 mm Debye-Scherer powder camera. The data were fitted by a Nelson-Riley correlation to determine the lattice parameter. A petrographic thin-section was prepared of the other part of the spherule. Microscopy and electron microprobe analysis were performed on the thin section

to determine crystal structure and chemical composition. Ninety-four spherules of compositions varying from 0.1 to 98.6 m/o Y2O3 in ZrO2 were examined by the X-ray powder diffraction method for lattice, parameter, and by the electron microprobe X-ray analyzer for chemical composition. Data from the quenched spherules are in excellent agreement with previous work. Dissert. Abstr.

N73-25630 Northwestern Univ., Evanston, Ill.
THE THERMAL CONDUCTIVITY OF TWO SIMPLE ANTIFERROMAGNETS: RUBIDIUM MANGANESE FLUORIDE AND MANGANESE FLUORIDE Ph.D. Thesis
John Charles Gustafson 1972 251 p
Avail: Univ. Microfilms Order No. 72-32447

The magnetic field dependence of the thermal conductivity has been used to investigate the magnon contribution to the total heat current and the magneto-elastic coupling in the simple antiferromagnets RbMnF3 and MnF2. The measurements were performed in a He cryostat capable of covering the temperature range 0.3k to 100K. A magnetic field was applied to the sample by a 50 kOe split-coil superconducting magnet. The split coil configuration allowed several heat flow and field directions to be studied. The samples were prepared by first manufacturing the fluoride-salt, treating the salt in a HF atmosphere, and finally pulling the single crystal from the melt. The thermal conductivity measurements on both RbMnF3 and MnF2 show no evidence for magnon conductivity. The zero field results for RbMnF3 are explainable in terms of phonons and phonon scattering mechanisms. Dissert. Abstr.

N73-25631*# Boeing Commercial Airplane Co., Seattle, Wash.
CYCLIC DEBONDING OF ADHESIVE JOINTS Summary Report
D. J. Hoffman and R. R. June Washington NASA Jun. 1973 73 p refs
(Contract NAS1-8858)
(NASA-CR-2207; D6-60136-5) Avail: NTIS HC $3.00 CSCL 11D

Bonded lap joints were manufactured and tested under static and fatigue loading. Specimens were designed to fail in the bondline, and all fatigue tests included monitoring the crack growth to failure. Test specimens included aluminum details joined by two different adhesives. Specimens also included titanium and boron-epoxy details joined by an epoxy laminating resin. Additonal program variables included bondline thickness, adherend and spice plate thickness, specimen width, and specimen fabrication procedure. Adhesive aging was found to be generally detrimental to the lives of most of the specimens bonded with one adhesive system. Adhesive material was found to have a major influence on debond rate. Co-cured titanium/boron-epoxy specimens were found to resist debonding better than specimens fabricated with a sequential cure. Splice plate thickness and test section width were found to have little effect on debond rate. The data also suggested the existence of an optimum bondline thickness.
Author

N73-25632*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION AND WEAR BEHAVIOR OF GLASSES AND CERAMICS
Donald H. Buckley 1973 33 p refs Proposed for presentation at Surface and Interfaces of Glass and Ceramics, Alfred, N. Y., 27-29 Aug. 1973
(NASA-TM-X-68255; E-6886-2) Avail: NTIS HC $3.75 CSCL 11D

Adhesion, friction, and wear behavior of glasses and ionic solids are reviewed. These materials are shown to behave in a manner similar to other solids with respect to adhesion. Their friction characteristics are shown to be sensitive to environmental constituents and surface films. This sensitivity can be related to a reduction in adhesive bonding and the changes in surficial mechanical behavior associated with Rehbinder and Joffe effects. Both friction and wear properties of ionic crystalline solids are highly anisotropic. With metals in contact with ionic solids the fracture strength of the ionic solid and the shear strength in the metal and those properties that determine these will dictate which of the materials undergoes adhesive wear. The chemical activity of the metal plays an important role in the nature and strength of the adhesive interfacial bond that develops between the metal and a glass or ionic solid. Author

N73-25633*# Pressure Systems, Inc., Los Angeles, Calif.
RUBBER COMPOSITIONS FOR HYDRAZINE SERVICE Final Report
John Repar 15 Apr. 1973 41 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952864; PSI Proj. 7034000)
(NASA-CR-131836) Avail: NTIS HC $4.25 CSCL 11D

Forty-three compounds were formulated and tested for physical properties and hydrazine compatibility. Variables introduced include silicon dioxide filler loading level and particle size. Both butyl and ethylene-propylene rubbers were employed as well as various vulcanization systems. The data showed that compounds containing butyl and butyl blended with ethylene propylene could not be distinguished from ethylene propylene alone as far as chemical properties were concerned. A trend noted was that a filler level with higher silicon dioxide loading exhibited better hydrazine compatibility. Particle size variation did not show any consistent trends. Any of the vulcanization systems employed appeared to be satisfactory. A refined technique for dissolving aluminum cores from EPT-10 bladders was also tested. Author

N73-25634# Rutherford High Energy Lab., Chilton (England). Chemical Technology Center.
IRRADIATION DAMAGE STUDIES OF SOME EPOXY RESIN SYSTEMS OF REDUCED VISCOSITY
D. Evans, J. T. Morgan, and G. B. Stapleton Apr. 1972 19 p refs
(RHEL/R-249) Avail: AEC Depository Libraries; UK 25p

Postirradiation mechanical properties are given for a number of epoxy materials, including some glycidyl amine resin systems having reduced viscosities. Author (NSA)

N73-25635# Midwest Research Inst., Kansas City, Mo.
FATIGUE OF BORON-ALUMINUM COMPOSITES Technical Report, 1 Apr. 1971 - 31 Mar. 1972
J. R. Hancock Nov. 1972 34 p refs
(Contract F33615-71-C-1379)
(AD-757213; AFML-TR-72-113) Avail: NTIS HC $3.00 CSCL 11/4

The mechanisms of fatigue failure in composites of boron-6061 aluminum under oscillating tensile loads were determined and a phenomenological model of fatigue failure is outlined. A linear relationship between fatigue limit and filament content is suggested as an interim criterion for the specification of minimum acceptable composite fatigue properties and for use in the design of structures. Unidirectional filament reinforcement was less effective under cyclic loads then under static loads, and the low cycle resistance of the composites was sharply reduced when SiC coated filaments were used as the reinforcements. (Author Modified Abstract) GRA

N73-25636# British Steel Corp., London (England). Metallurgy Dept.
THE X-RAY FLUORESCENCE ANALYSIS OF ALUMINOSILICATE REFRACTORIES
A. D. Ambrose Oct. 1972 45 p refs Supersedes MG/CCE/525/71
(PB-214233/9; MG/CC/565/72; MG/CCE/525/71) Avail: NTIS HC $3.00 CSCL 11B

The application of X-ray fluorescence to the analysis of aluminosilicate refractories was studied. The direct crushing and pelletizing method of specimen preparation was thoroughly explored and although for the samples studied, results for the minor constituents were encouraging, those for the major constituents were semi-quantitative only. Particle size and mineralogical effects are sources of error and for accurate analysis a preliminary fusion of the sample is required. Various fusion techniques and subsequent methods of specimen preparation were examined and with the procedure finally adopted, involving analysis of a cast borate bead with a polished surface, reproducibility was obtained equal to that from counting statistics, thus enabling the high inherent precision of XRF analysis to be achieved in practice. Author (GRA)

N73-25637# Bureau of Mines, Washington, D.C.
DISPERSING ANTIFERROMAGNETIC PRECURSORS TO PREPARE MAGNETIC FLUIDS
George W. Reimers and Sanaa E. Khalafalla Dec. 1972 21 p refs
(PB-214309/7; BM-RI-7702) Avail: NTIS HC $3.00 CSCL 11G

Dispersive methods to prepare magnetic colliods were developed and the grindability of magnetite and wustite to colloidal size was compared for identical conditions; magnetic responses of the resulting preparations were observed. Author (GRA)

N73-25638# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
PIEZO- AND PYROELECTRICITY IN POLYMER ELECTRETS
M. G. Broadhurst, C. G. Malmberg, F. I. Mopsik, and W. P. Harris 1 Mar. 1973 17 p refs Presented at Conf. on Electrets, Charge Storage and Transport in Dielectrics, Miami Beach, Fla., 8-13 Oct. 1972 Submitted for publication
(Contract NAonr-27-73; NR Proj. 356-522)
(AD-758730; NBSIR-73-153; TR-1) Avail: NTIS CSCL 11/9

A model for a polymer electret, based on an elastically isotropic solid with orientationally frozen molecular dipoles, was developed and tested experimentally. This electret is shown to be both piezoelectric and pyroelectric. The polarization is shown to change with mechanically and thermally induced strains in the polarization direction. The currents generated by the electret will be proportional to the strain rate and, for thin contact electrodes and uniform strains, unaffected by the presence of real charges. Poly (vinyl chloride) films were poled at 80C, just above their glass transition temperature. The pressure- and temperature-induced short-circuit currents in the polarization direction equalled 0.15(pA/sq cm)/(bar/min) and 2.2(pA/sq cm)/(K/min) respectively for a specimen poled at 320 kV/cm. These currents were reversible and proportional to the rate of temperature or pressure change, proportional to poling voltage up to 320 kV/cm, in the direction corresponding to increasing polarization with increasing pressure and decreasing temperature, about 1.6 times as great for temperature induced strains as for equivalent pressure induced strains, and about 2-4 times as great in magnitude as expected from dielectric constant measurements. (Author Modified Abstract) GRA

N73-25639# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
LOAD ABSORPTION AND INTERACTION OF TWO ADJACENT FILAMENTS IN A FIBER-REINFORCED MATERIAL
Thomas G. Carne Feb. 1973 76 p refs
(Contract N00014-67-A-0094-0020; NR Proj. 064-031)
(AD-759729; TR-28) Avail: NTIS CSCL 11/4

The investigation is concerned with the interaction -- as far as load-absorption is concerned -- of a pair of identical parallel elastic filaments in a fiber-reinforced composite material. The filaments are assumed to have uniform circular cross-sections, are taken to be semi-infinite, and are supposed to be continuously bonded to an all-around infinite matrix of distinct elastic properties. At infinity the matrix is subjected to uniaxial tension parallel to the filaments. Two separate but related problems are treated. In the first both filaments extend to infinity in the same direction and their terminal cross-sections are coplanar. In the second problem the filaments extend to infinity in the same direction and their terminal cross-sections need no longer be coplanar, the two filaments being permitted to overlap partly. (Author Modified Abstract) GRA

N73-25640# Polytechnic Inst. of Brooklyn, N.Y.
RESPONSE OF GLASS FIBER REINFORCED EPOXY SPECIMENS TO HIGH RATES OF TENSILE LOADING Final Report, Apr. 1971 - Aug. 1972
A. F. Armenakas and C. A. Sciammarella Jan. 1973 60 p refs
(Contract F33615-71-C-1533)
(AD-759153; AFML-TR-72-124) Avail: NTIS CSCL 11/4

The object of this investigation is to establish experimentally the mechanical properties, and the mode of failure of glass fiber-reinforced epoxy plates subjected to high rates of strain (30,000 in/in/min) in the direction of the fibers, on a specially designed impact loading machine propelled by explosives. The results are correlated with those obtained by testing glass, fiber-reinforced epoxy plates subjected to various low rates of strain (0.0265 in/in/min 0.66 in/in/min and 26.5 in/in/min). Author (GRA)

N73-25641# Solar, San Diego, Calif.
EFFECT OF INTERFACES IN METAL MATRIX COMPOSITES ON MECHANICAL PROPERTIES Final Technical Report, 1 Aug. 1971 - 1 Aug. 1972
Mark J. Klein and Arthur G. Metcalf Nov. 1972 169 p
(Contract F33615-70-C-1814; AF Proj. 7353)
(AD-759204; RDR-1701-2; AFML-TR-72-226) Avail: NTIS CSCL 11/4

A study was made of the effect of the interface in aluminum (6061)/boron and aluminum (6061)/silicon carbide coated boron (Borsic) on selected mechanical properties. The object of the study was to determine the relationship of the interface condition to mechanical properties and to control interface effects so that composite properties can be optimized. GRA

N73-25642# Watervliet Arsenal, N.Y. Benets Weapons Lab.
A COUPLE STRESS THEORY FOR LAMINATED MEDIA
Charles R. Thomas Feb. 1973 37 p refs
(DA Proj. 1F0-61102-A-35D)
(AD-759133; R-WV-T-X-8-73) Avail: NTIS CSCL 11/4

A derivation of a couple-stress theory for a laminated medium is developed in detail. Simple thickness modes are used to show the relationship of the theory to a corresponding effective modulus theory. Simple wave propagation problems are used to show when the new theory is dispersive in nature. Author (GRA)

N73-25643# Naval Ordnance Lab., White Oak, Md.
EVALUATION OF POTTING COMPOUNDS BY ELECTRICAL RESISTIVITY TECHNIQUES USING THE CONTINUOUS CURRENT MONITORING DEVICE (CCMD) Final Report, Aug. - Nov. 1972
Doris S. Lequin and Richard D. Ezell 23 Feb. 1973 78 p refs
(AD-759005; NOLTR-73-10) Avail: NTIS CSCL 11/9

The Continuous Current Monitoring Device (CCMD) for evaluating potting compounds was first reported in 1956. It is based upon electrical resistivity measurement techniques. As the use of epoxy resin systems for potting electronics increased, a need was felt to know more about the polymerization process in relationship to the storage life of the potted units. CCMD was found eminently suitable for evaluating the long-term stability of such epoxy resins. The normal calculation and plotting of the test data is time consuming, so this part of the data analysis was computerized. All the computer programs are included in the appendices. The purpose of the report is to review the subject of CCMD evaluation of potting compounds and to discuss the latest methods for calculating and presenting the results. A typical analysis for one epoxy resin system, formulated into cured compounds ranging from very rigid to very flexible, is used to illustrate the use and interpretation of the CCMD data. Previously reported data are also given to further illustrate data analysis techniques. (Author Modified Abstract) GRA

N73-25644# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
THE DYNAMIC COMPRESSION AND RELEASE OF MECHANICAL MIXTURES IN THE PRESENCE OF A PHASE CHANGE
Alan K. Hopkins Dec. 1972 92 p refs
(AF Proj. 7360)
(AD-759150; AFML-TR-72-264) Avail: NTIS CSCL 11/4

An experimental investigation of the shock compression and release behavior of simple homogeneous mechanical mixtures of selected solids was conducted to provide a basis for modeling the dynamic behavior of continuous filament reinforced and plate laminate composites at stress levels where hydrostatic behavior is approximated. The binary mixtures investigated all consisted of a polyethylene matrix with the rigid component chosen from the following: 40 w/o, 70 w/o, and 90 w/o copper; 94.5 w/o tantalum and 70 w/o alumina. The rule of mixtures described the shock loading and release up to the stress required for

shock melting the polyethylene; streak photographs and flash x-radiographic techniques gave identical measurements of the free surface velocity. (Author Modified Abstract) GRA

N73-25645# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF WINDING CONDITIONS OF THE RESIDUAL STRESSES IN WINDING PRODUCTS MADE OF GLASS-FIBRE REINFORCED PLASTICS
V. L. Blagonadeshin, G. V. Mishenkov, V. P. Nikolaev, E. M. Varushkin, and Yu. A. Lapin 18 Apr. 1973 12 p Transl. into ENGLISH from Tr. Energeticheskii Inst. (USSR), no. 74, 1970 p 94-98
(AD-759632; FTD-HT-23-169-73) Avail: NTIS CSCL 11/9
Tests were conducted for the purpose of studying the influence of preheating of the mandrel and the glass tape on the magnitude of residual stresses. GRA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-25646 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATION OF AUTOCORRELATION AND CROSS-CORRELATION FUNCTIONS FOR A NUMBER OF REALISATIONS OF A RANDOM PROCESS
E. B. Zhuravleva and R. L. Kagan [1973] 8 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), v. 289, 1971 p 20-28
(NLL-M-22887-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon
An algorithm and a computer program for obtaining estimates of autocorrelation (covariance) and cross-correlation (covariance) functions are presented. The method used in the calculation differs from the standard method owing to the fact that available sequences of meteorological measurements usually contain gaps. As a result, the adopted method of calculation is analyzed in depth, and a short description of the program is provided.
Author

N73-25647 Polytechnic Inst. of Brooklyn, N.Y.
THE DESIGN OF DIGITAL FILTERS WITH FINITE PRECISION Ph.D. Thesis
Richard C. Gibbons 1972 218 p
Avail: Univ. Microfilms Order No. 72-28232
Discrete mathematical programming techniques are applied to the design of digital filters - accounting for their limited precision. The design entail non-recursive digital filters (NRDF) in both the time and frequency domains. The performance criteria is the minimization of the L sub 1 and L sub 2 L sub infinity norms with discrete constraints. It is shown that either improved performance or more economical solutions can be achieved by choosing the optimal discrete parameters. Extensions are indicated which allow for the limited precision design of NRDF with noisy inputs and for the limited precision design of recursive digital filters. Dissert. Abstr.

N73-25648*# Scientific Translation Service, Santa Barbara, Calif.
THE FOURIER COEFFICIENTS OF THE EISENSTEIN SERIES OF THE SECOND DEGREE
Hans Haass Washington NASA Jun. 1973 32 p refs Transl. into ENGLISH from Mat.-Fys. Medd., Kgl. Dan. Vidensk. Selsk. (Denmark), v. 34, no. 7, 1964 p 3-24
(Contract NASw-2483)
(NASA-TT-F-14937) Avail: NTIS HC $3.75 CSCL 12A
The Fourier coefficients a sub k (T) of the Eisenstein series to the n-th degree modulus group and to -k dimension can be described as the product of certain p-adic representation densities. By computation of these densities, in the case n = 2, one arrives at an explicit formula for the a sub k (T) for primitive matrices T. By means of a recursion formula, drawn from the generalized Hecke operator theory, the computation of any Fourier coefficients can be reduced to this special case. Now in the case n = 2 with fixed k, a detailed analysis for the rational numbers a sub k (t) yields a common denominator composed only of irregular prime numbers. In particular, the greatest common divisor of all a sub k (T) is reported for k = 4, 6, 8, 10, 12. Author

N73-25649*# Scientific Translation Service, Santa Barbara, Calif.
ON THE FOURIER COEFFICIENTS OF THE SECOND DEGREE EISENSTEIN SERIES
Hans Maass Washington NASA Jun. 1973 16 p refs Transl. into ENGLISH from Mat.-Fys. Medd., Kgl. Dan. Vidensk. Selsk. (Denmark), v. 38, no. 14, 1972 p 2-12
(Contract NASw-2483)
(NASA-TT-F-14936) Avail: NTIS $3.00 CSCL 12A
The analysis of the Fourier coefficients a sub k (T) of the second degree Eisenstein series of weight k is continued. Coefficient relations of the partial sum type are established, with which the calculation of the coefficients a sub k (T) to non-primitive T are reduced to those for primitive T. On the basis of the multiplicative properties of the Fourier coefficients, the first examples of zeta functions which are defined by means of the coefficients a sub k (T) and which have Eulerian product expansions are obtained. Author

N73-25650*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ALGORITHM FOR GENERATING ALL POSSIBLE 2(p-q) FRACTIONAL FACTORIAL DESIGNS AND ITS USE IN SCIENTIFIC EXPERIMENTATION
Steven M. Sidik Washington Jun. 1973 33 p refs
(NASA-TN-D-7327; E-7365) Avail: NTIS HC $3.00 CSCL 12A
An algorithm and computer program are presented for generating all the distinct 2(p-q) fractional factorial designs. Some applications of this algorithm to the construction of tables of designs and of designs for nonstandard situations and its use in Bayesian design are discussed. An appendix includes a discussion of an actual experiment whose design was facilitated by the algorithm. Author

N73-25651*# Mississippi State Univ., State College.
AN INNOVATIVE APPROACH TO COMPENSATOR DESIGN
Jerrel R. Mitchell and Willie L. McDaniel, Jr. Washington NASA May 1973 139 p refs
(Contract NAS8-21377)
(NASA-CR-2248; M216) Avail: NTIS HC $3.00 CSCL 12A
The design is considered of a computer-aided-compensator for a control system from a frequency domain point of view. The design technique developed is based on describing the open loop frequency response by n discrete frequency points which result in n functions of the compensator coefficients. Several of these functions are chosen so that the system specifications are properly portrayed; then mathematical programming is used to improve all of these functions which have values below minimum standards. To do this, several definitions in regard to measuring the performance of a system in the frequency domain are given, e.g., relative stability, relative attenuation, proper phasing, etc. Next, theorems which govern the number of compensator coefficients necessary to make improvements in a certain number of functions are proved. After this a mathematical programming tool for aiding in the solution of the problem is developed. This tool is called the constraint improvement algorithm. Then for applying the constraint improvement algorithm generalized, gradients for the constraints are derived. Finally, the necessary theory is incorporated in a Computer program called CIP (compensator Improvement Program). The practical usefulness of CIP is demonstrated by two large system examples. Author

N73-25652# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
ON THE EVENT HORIZON OF THE T-S METRICS
Akira Tomimatsu and Humitaka Sato May 1973 8 p refs
(RIFP-177) Avail: NTIS HC $3.00
The nature of the surface x=1 of the Tomimatsu-Sato metrics is examined and it is shown that the surface is an event horizon with the same structure for all the metrics. Author

N73-25653*# Massachusetts Inst. of Tech., Cambridge. Decision and Control Sciences Group.
CONTROL OPTIMIZATION, STABILIZATION AND COMPUTER ALGORITHMS FOR AIRCRAFT APPLICATIONS Status Report, 1 Jan. - 1 May 1973
S. K. Mitter Mar. 1973 36 p refs
(Grant NGL-22-009-124; MIT Proj. DSR 76265)
(NASA-CR-133002; SR-14; ESL-SR-494) Avail: NTIS HC $4.00 CSCL 12A

Computationally useful algorithms are considered that can aid the control engineer in designing systems control in linear time invariant dynamics for aircraft applications. Structural aspects of system identification, matrix parameterization, and the effect of feedback on identifiability of systems. Adaptive and stochastic control model constructions are projected, and a method for approximate identification of aircraft characteristics and subsequent generation of control signals is outlined. G.G.

N73-25654*# Connecticut Univ., Storrs. Dept. of Electrical Engineering.
POLE AND ZERO PLACEMENT IN MULTIVARIABLE CONTROL SYSTEMS
Banavar Sridhar May 1973 98 p refs
(Grant NGL-07-002-002)
(NASA-CR-132962; TR-73-2) Avail: NTIS HC $7.00 CSCL 12A

A method is proposed for designing multivariable systems based on an alternate derivation of Davison's theorem on pole placement and the solution of the nonlinear equations for the feedback gains by the least square error method. Output feedback is used to control a complex dynamical system. The freedom in design, after allocating poles, is used to place zeros and/or satisfy other design objectives. This method results in algorithms which are computationally attractive. However, this is done at a considerable sacrifice in terms of the design freedom available. For a system with m inputs and p outputs only m + p variables are available instead of mp variables. Author

N73-25655# Wisconsin Univ., Madison. Dept. of Statistics.
SOME RECENT ADVANCES IN FORECASTING AND CONTROL, PART 2
George E. P. Box, Gwilym M. Jenkins, and John F. MacGregor Aug. 1972 40 p refs
(Grant AF-AFOSR-2363-72; AF Proj. 9769)
(AD-757900; UWIS-DS-72-31-Pt-2; AFOSR-73-0512TR-Pt-2) Avail: NTIS CSCL 12/1

The paper outlines an approach to discrete stochastic control which uses these models to typify the dynamic and stochastic characteristics of the system. This description of the system together with the type of cost function involved is shown to lead to appropriate optimal control schemes. Feedforward and feedback control schemes are worked out for situations typical of those occurring in the chemical and other process industries. A control problem more typical of situations arising in the parts manufacturing industries is shown to lead naturally to a control charting procedure very similar to Shewhart's which has been used very successfully in these industries. (Author Modified Abstract) GRA

N73-25656# Naval Research Lab., Washington, D.C.
DESCRIPTION OF AN ALPHA-BETA FILTER IN CARTESIAN COORDINATES Interim Report
Ben H. Cantrell 21 Mar. 1973 52 p refs
(NRL Proj. R02-54; RF05151)
(AD-759011; NRL-7548) Avail: NTIS CSCL 17/9

A procedure for determining the mean and covariance errors in an alpha-beta filter operating in Cartesian coordinates was found. The results obtained from this procedure were compared to an alpha-beta filter operating in polar coordinates. Assuming that the input measurements in polar coordinates were Gaussian distributed, it was shown that at the output of the coordinate transformations the noise could be approximated accurately by a Gaussian distribution for typical radar data. Closed-form solutions under steady-state conditions were found for the output covariances for the polar coordinate filter and for the Cartesian coordinate filter when the target is stationary. These covariances depended upon alpha, beta, and the measurement variances. For moving targets, the Cartesian coordinate filter yielded output covariances which were nonstationary. Their values depended upon alpha, beta, measurement variances, target trajectory, target speed, and sampling time. The mean errors were discussed. Under fading conditions both the mean and covariance errors increased during the fading time. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-25657 National Lending Library for Science and Technology, Boston Spa (England).
SYNOPTIC CONDITIONS OF PARTICULARLY SEVERE ICING OF MERCHANT SHIPS
J. G. Kaplina and K. I. Chukanin [1973] 8 p refs Transl. into ENGLISH from Tr. Arkticheskogo i Antarkt. Nauchno-Issled. Inst. (Leningrad), v. 298, 1972 p 168-173 No diagrams etc. to be used in conjunction with original book
(NLL-M-22981-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The synoptic meteorological conditions associated with the most severe icing on merchant ships are discussed. Geographical areas in which most severe icing is encountered are identified. The climatology of the identified areas which causes the icing problem is reported. Specific examples of extreme icing conditions are reported. Author

N73-25658 National Lending Library for Science and Technology, Boston Spa (England).
ON THE QUALITY OF PRECIPITATION, SURFACE PRESSURE, TEMPERATURE, AND DEW POINT FORECASTS
B. D. Uspenskij and O. A. Davydova [1973] 17 p refs Transl. into ENGLISH from Gidromet. Nauchno-Issled. Cent. SSSR (Leningrad), no. 82, 1971 p 50-57
(NLL-M-22980-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Methods for improving the weather forecasting of precipitation, surface pressure, temperature, and dew point are discussed. A method of quantitative short-period forecasting of precipitation was evaluated. A method of forecasting dew point depending on the amount of cloud and the wetness of the underlying surface is examined. The method depends upon the following factors: (1) the water vapor distribution in the cumulus cloud, (2) the mean speed of the convection current, (3) the duration of the convection rain, and (4) the loss of water from the cloud by evaporation into the surrounding space. Author

N73-25659 National Lending Library for Science and Technology, Boston Spa (England).
LONG-TERM CYCLIC FLUCTUATIONS OF ATMOSPHERIC PRECIPITATION IN THE USSR
Drozdov. O. A. and A. S. Grigoreva [1973] 165 p refs Transl. into ENGLISH from Glav. Uprav. Gidromet. Slus., Glav. Geof. Obs., Gidrometeoizdat (USSR), 1971 165 p
(NLL-M-22891-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 7 NLL photocopy coupons

Fluctuations in precipitation of a cyclic character, were studied over the U.S.S.R. during the summer and winter. A technique of investigating time series is described, with the breakdown of the steady-state of the fluctuation spectrum and the possibility of using autocorrelation in the investigation of a wide range of frequencies. The space-time structure of the cyclic state of precipitation and the probability of breakdown of its steady state is examined. The relative stability in time of the cyclic nature of precipitation allows it to be used in long range background forecasts. A connection is shown between the cyclic characteristics and the accuracy of the climate norms and also between prolonged periods of drought and the temperature in the Arctic regions. The synchronous relationship of the temperature and precipitation anomalies at one point, also of precipitation anomalies with the temperature gradients, was investigated. Author

N73-25660 National Lending Library for Science and Technology, Boston Spa (England).
ON THE NATURE OF PRECIPITATION OVER TROPICAL LATITUDES OF THE OCEANS
S. P. Hromov [1973] 8 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), 1971 p 142-145
(NLL-M-22848-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Observations from the 1970 expedition of the research ship Academician Sirsov were used to study the precipitation of raindrops from convective clouds in the intertropical zone and in the tradewinds over the Atlantic Ocean. Heavy showers were noted with the intertropical convergence zone, while the tradewinds were associated with very small droplets. In the intertropical convergence zone, ice formation was observed at the top of the clouds. F.O.S.

N73-25661 National Lending Library for Science and Technology, Boston Spa (England).
PERIODICITY, ASPECTS OF THE PERSISTENCE NONTRANSIENT EURO-ATLANTIC BLOCKING SYSTEMS
M. Montalto, M. Conte, and M. Urbani [1973] 20 p refs Transl. into ENGLISH from Riv. Meteorol. Aeron (Rome), v. 31, no. 4, 1971 p 401-410
(NLL-M-22831-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The annual distribution of the days affected by blocking situations lasting for five days or more over the Euro-Atlantic region during the twenty-year period 1951 - 1970 is examined in detail. A quasi-biennial periodicity is found. On this periodicity there is superimposed an anomaly with a period of about five years and six months. It is pointed out also that the number of days affected by blocking action is almost constant in each of the five-year periods into which it is possible to divide the twenty-year period. Evidence is also submitted to show that the maxima of activity of blocking systems undergo in successive five-year periods a displacement alternately from the first to the second half of the year. Finally it is shown that cyclonic vortices have a predominating influence on this displacement. Author

N73-25662 National Lending Library for Science and Technology, Boston Spa (England).
A LARGE DUST CLOUD CARRIED OFF TO SEA FROM THE CONTINENT OF AFRICA
A. L. Kac and V. S. Belenkij [1973] 8 p refs Transl. into ENGLISH from Gidromet. Nauchn.-Issled. Cent. SSSR (Leningrad). 1971 p 154-159
(NLL-M-22850-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Synoptic analysis of a dust cloud carried out to sea from the west coast of Africa show that it is caused by an increase in atmospheric pressure gradients from 1028-1032 to 1035-1038 mb over the tropical part of Africa. This situation is attributed to a shift of the Azores high towards the Pyrenean peninsula. G.G.

N73-25663 National Lending Library for Science and Technology, Boston Spa (England).
THE QUASI-BIENNIAL OSCILLATION AND THE EVOLUTION OF CIRCULATION AND WEATHER IN THE ATLANTIC-EURASIAN SECTOR OF THE HEMISPHERE IN 1968 - 1970
V. A. Bugaev and A. L. Kac [1973] 22 p refs Transl. into ENGLISH from Gidromet. Nauchn.-Issled. Cent. SSSR (Leningrad), 1971 p 25-40
(NLL-M-22853-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The effect of general atmospheric circulation on large scale and persistent weather features is discussed. Specific analysis is directed toward the quasi-biennial oscillation and its effect on the circulation and weather in the Atlantic-Eurasian sector of the hemisphere in 1968 to 1970. The mechanism for the formation of the westerly currents of the quasi-biennial oscillation is described. Tables are included to show the effects of zonal, meridional, warm and cold synoptic processes during winter and spring seasons. Author

N73-25664 National Lending Library for Science and Technology, Boston Spa (England).
PROGRAM FOR ONE-LEVEL OBJECTIVE ANALYSIS BY OPTIMAL INTERPOLATION
N. K. Grib and I. I. Poljak [1973] 6 p ref Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), v. 289, 1971 p 5-10
(NLL-M-22883-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A description of a program is provided for one-level objective analysis of meteorological fields by the method of optimal interpolation. The program is designed to make investigations and to obtain the accuracy characteristics of the resultant estimates. A short description of the calculation procedures is also presented. Author

N73-25665 National Lending Library for Science and Technology, Boston Spa (England).
CONSTANT HEAT DEVICE FOR THE WINDMILL HEAT TYPE ANEMOMETER
Seiichi Onozaki and Tamotsu Kawakami [1973] 5 p refs Transl. into ENGLISH from Weather Service Bull. (Tokyo), v. 39, 1972 p 51-53
(NLL-M-29974-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A heating device to prevent icing for windmill type anemometers is described. A temperature and humidity detector is used for switching infrared lamps on and off. Satisfactory results were obtained at Mt. Ibuki weather station. F.O.S.

N73-25666 National Lending Library for Science and Technology, Boston Spa (England).
FUNDAMENTAL PROCESSES DURING THE DEVELOPMENT OF CUMULUS
J. Janouska [1973] 19 p refs Transl. into ENGLISH from Hydromet. Ustav., Meteorol. Zpravy (Prague), v. 24, 1971 p 33-37
(NLL-M-22840-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The dynamics of cumulus cloud development based on hydrodynamic and thermodynamic concepts are discussed. The characteristics of cumulus convective clouds to show: (1) the life cycle, (2) the dimensions, (3) vertical currents, (4) water content, and (5) temperature. The fundamental equations for the dynamics of cumulus clouds are developed. The equations are based on the equations of motion for a compressible fluid. Author

N73-25667 National Lending Library for Science and Technology, Boston Spa (England).
ANALYTICAL APPROXIMATION OF ADVECTION NEAR THE GROUND
H. Ertel [1973] 5 p refs Transl. into ENGLISH from Magyar Met. Tars. Foly., Idojaras (Budapest), v. 74, 1970 p 497-499
(NLL-M-22820-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The dynamics of the horizontal movement of air masses are discussed. Starting with an orthogonal Cartisian coordinate system, and using the imaginary unit to represent the position vector of an air mass Lagrangian, the equation for determining the approximate displacement of an air mass is derived. F.O.S.

N73-25668 National Lending Library for Science and Technology, Boston Spa (England).
THE IMPORTANCE OF THE DEPTH OF THE MIXING LAYER IN AIR POLLUTION STUDIES
M. Gubola [1973] 11 p refs Transl. into ENGLISH from Hivat. Kiad. (Budapest), v. 35, 1970 p 405-414
(NLL-M-22807-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The measurement of the mixing layer depth is discussed in terms of pollution potential. The diffusion is considered of effluents in the layer of air near the ground which depends on the stability, depth of the mixing layer, and the sources of pollution. F.O.S.

N73-25669 National Lending Library for Science and Technology, Boston Spa (England).
THE STATE AND PROSPECTS OF THE DEVELOPMENT OF

METEOROLOGICAL INVESTIGATIONS OF AIR POLLUTION
M. E. Berljand [1973] 17 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), Jul. 1968 p 11-23
(NLL-M-22885-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Air pollution of the biosphere is discussed in terms of atmospheric diffusion, emission impurities, concentrations, inversions, turbulence, and wind profiles. F.O.S.

N73-25670 Washington Univ., Seattle.
REMOTE DETERMINATION OF THE TRANSVERSE WIND VELOCITY AND STRUCTURE CONSTANT USING NARROW BEAM WAVES Ph.D. Thesis
James Michael Heneghan 1972 138 p
Avail: Univ. Microfilms Order No. 72-28604

A method is developed for remotely determining the average transverse wind velocity and the atmospheric structure constant (strength of turbulence) at N points along a line-of-sight path. The technique avoids the basic instability problem that was encountered in previous work, limiting the calculations to one or two points. The method involves the inversion of an integral equation that has been developed for a focused beam wave. The measured data, the amplitude correlation, and the amplitude and phase structure functions, are linearly related to the unknown structure constant. A statistical inversion procedure is developed through the minimization of the errors in the unknown. The solutions are dependent upon the statistical properties of the unknown as well as the input data.
Dissert. Abstr.

N73-25671 International Geophysical Year World Data Center A, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 8, NO. 7, JULY 1971
1972 228 p
Avail: National Climatic Center, Federal Building, Asheville, N. C. 28801 Attn: Publications HC $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations, and current month means and standard deviations are also presented. Author

N73-25672 International Geophysical Year World Data Center A, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 8, NO. 8, AUGUST 1971
NOAA 1972 245 p
Avail: National Climatic Center, Federal Building, Asheville, N. C. 28801 Attn: 2 Publications HC $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations, and current month means and standard deviations are also presented. Author

N73-25673 International Geophysical Year World Data Center A, Asheville, N.C.
HIGH ALTITUDE METEOROLOGICAL DATA, VOLUME 8 NO. 9, SEPTEMBER 1971
NOAA 1972 215 p
Avail: National Climatic Center, Federal Building, Asheville, N. C. 28801 Attn: Publications HC $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations, and current month means and standard deviations are also presented. Author

N73-25674 Florida State Univ., Tallahassee.
A COMPARISON OF CUMULUS PARAMETERIZATION TECHNIQUES IN NUMERICAL INTEGRATIONS OF AN EASTERLY WAVE Ph.D Thesis
Benedict Frank Ceselski 1972 128 p
Avail: Univ. Microfilms Order No. 72-31386

An improved quasi-Lagrangian primitive equation prediction model has been developed for short-range limited area tropical integration. Comparative forty-eight hour forecasts were made utilizing seven different cumulus heating functions, one being zero cumulus latent heat release. Initial data were that of a nondeveloping easterly wave in the Caribbean. Concurring results among forecasts were consistent with the previous topical scale analysis of Charney. For the easterly wave of moderate intensity, computer vertical motions indicated essentially no coupling of upper and lower tropospheric motion outside convective areas and only minimal coupling in regions of cumulus latent heat release. Seventy to eighty percent of the ascending motion and eddy kinetic energy produced within the wave was estimated to be the direct result of parameterized cumulus latent heat release. Dissert. Abstr.

N73-25675 Wisconsin Univ., Madison.
COHERENCE CHARACTERISTICS OF HORIZONTAL WIND COMPONENTS NEAR THE WIND Ph.D. Thesis
Stephen Berman 1972 120 p
Avail: Univ. Microfilms Order No. 72-23298

Horizontal wind speed observations from a micrometeorological mast array at Aberdeen Proving Ground, Maryland, are analyzed in terms of coherence statistics. The turbulence sensors consisted of twelve fast response bivane-anemometers mounted at heights of 1 and 3 m on six masts. Two different mast configurations were employed: a single north-south line of six masts, 360 m long; and two parallel north-south lines, 300 m long and 30 m apart, of three masts each. Thirteen observation periods (90 to 120 minutes long) under prevailing northerly flow were selected for study with sensors sampled every second. Surface roughness was modified by having the grass cover mowed in prescribed patterns. Dissert. Abstr.

N73-25676# Aeronautical Research Labs., Melbourne (Australia). Dept. of Supply.
ON THE PROBABILITY DISTRIBUTION OF WIND SPEEDS: THE NON-CENTRAL CHI2 MODEL
Douglas J. Sherman and M. R. Thomson Oct. 1972 30 p refs
(ARL/SM-Note-383) Avail: NTIS HC $3.50

A numerical analysis of the probability density of wind speeds is presented. A formula is developed for the upcrossings of the noncentral chi process with two degrees of freedom. It was found that the experimental data on the upcrossings do not fit as well as the upcrossings of a normal process. The discrepancy is caused by the fact that the wind speed and its derivative are independent. Author

N73-25677# National Weather Service, Silver Spring, Md. Techniques Development Lab.
AUTOMATED PROBABILITY FORECASTS OF CEILING AND VISIBILITY BASED ON SINGLE STATION DATA Final Report
Richard L. Crisci and Frank Lewis Feb. 1973 68 p refs
(Contract DOT-FA67WAI-131)
(FAA-RD-73-13) Avail: NTIS HC $5.50

A set of computer programs was developed to produce multiple linear regression equations for predicting the probability of specified ceiling and visibility categories at air terminals. The equations were based upon weather observations made solely at the terminal and were derived with the REEP screening technique from 329 possible predictors. The programs accepted raw data in a standard format, and a complete set of prediction equations for five time projections was produced for each of 50 stations in a single computer run. The accuracy of forecasts generated by the equations was evaluated for 20 terminals. Three measures of accuracy were used to compare the objective forecasts to persistence and climatology. The equations were superior for the P-score and the Allen utility score, but for percent corrrect, persistence was better than the equations for the 4-hour forecast and climatology was about as good as the equations at 10 and 16 hours. Author

N73-25678*# Appalachian State Univ., Boone, N.C. Dept. of Mathematics.
ESTIMATION IN A MODIFIED BINOMIAL DISTRIBUTION
Michael C. Carter Washington NASA Jun. 1973 21 p refs
(Contract NAS8-29286)

(NASA-CR-2280; M110) Avail: NTIS HC $3.00 CSCL 04B

Estimation techniques in a modified binomial distribution, developed to describe thunderstorm activity over a small area at Cape Kennedy, Florida, are compared. A compound model is also developed and compared with the original model. The minimum Chi square technique is compared with the maximum likelihood and method of moments techniques. The minimum Chi square technique, although useful in complicated models, compared poorly to the other techniques. The maximum likelihood and method of moments were comparable. The compound model fit better in every case based on a likelihood ratio test comparing the compound model with the modified binomial model using maximum likelihood estimators. Author

N73-25679*# New York Univ., N.Y. Dept. of Meteorological and Oceanography.

SUPPLEMENTARY NOTES ON SEA SURFACE TEMPERATURE ANOMALIES AND MODEL-GENERATED METEOROLOGICAL HISTORIES

Jerome Spar Dec. 1972 27 p refs

(Grant NGR-33-016-174)

(NASA-CR-132961) Avail: NTIS HC $3.50 CSCL 04B

In seasonal computations, the Mintz-Arakawa two-level model is found to be sensitive to a minor alteration in the computational program. Effects of the program change on monthly mean sea level pressure fields are small in the first month, but large in the second and third months, although the meteorolgical histories generated by both the original and modified programs are equally credible. The inherited effects of a transient (one month) sea surface temperature (SST) anomaly on the computed monthly mean sea level pressure fields over a period of a season are about as large in absolute magnitude as those generated in the model by a persistent (seasonal) SST anomaly. The effects of a transient SST anomaly in the North Pacific Ocean on monthly and seasonal temperature and precipitation in the eastern United States may be large enough to produce a change of one or two class intervals in these predicted weather elements. The model-generated precipitation in the equatorial region is also found to be sensitive to the sea surface temperature field in the North Pacific. Author

N73-25680# World Meteorological Organization, Geneva (Switzerland).

METHODS FOR THE APPROXIMATE SOLUTION OF TIME DEPENDENT PROBLEMS Global Atmospheric Research Program

H. Kreiss (Uppsala Univ.) and J. Oliger (Natl. Center for Atmospheric Res., Boulder, Colo.) Feb. 1973 130 p refs Prepared jointly with Intern. Council of Sci. Unions

(GARP-Publ-10) Avail: NTIS HC $8.50; WMO, Geneva 14 Sw.F.

Methods are discussed for obtaining approximate solutions to hyperbolic partial differential equations, which are encountered in dynamic meteorology and oceanography. The initial value problem for ordinary differential equations is discussed, and the concepts of stability and convergence are introduced. Several methods are examined and analyzed for computational efficiency. The Cauchy, or initial value, problem is treated for partial differential equations. A parallel treatment of the properties of the differential equations and of their approximations is carried out. Several methods are analyzed for computational efficiency. An outline of the theory for the differential equations and their approximations is accompanied by several examples of its application. The shallow water equation, finite difference grids, and mesh refinements are discussed. ESRO

N73-25681# Stockholm Univ. (Sweden). Inst. of Meteorology.

THE PRIMITIVE EQUATION MULTI-LEVEL PREDICTION MODEL AT THE INSTITUTE OF METEOROLOGY

Hilding Sundqvist Feb. 1973 51 p refs

(Contract SWEDSRC-2753-4)

(DM-8) Avail: NTIS HC $4.75

Modifications of a multilevel atmospheric prediction model based on the primitive equations of motion are discussed. An explicit planetary boundary layer treatment was introduced instead of the earlier treatment of friction and heat flux at the earth surface. A water vapor conveyance equation and large scale condensation were incorporated. An initialization procedure was developed, making it possible to run the model on real data objectively analyzed at the Swedish weather bureau. ESRO

N73-25682# Stanford Research Inst., Menlo Park, Calif.

LIDAR EVALUATION OF FOG DISSIPATION TECHNIQUES Final Report, 10 Nov. 1971 - 30 Nov. 1972

William Viezee, John Oblanas, and Ronald T. H. Collis Feb. 1973 123 p refs

(Contract F19628-72-C-0018; ILIR Proj. 9-71; SRI Proj. 1597)

(AD-758767; AFCRL-TR-73-0052) Avail: NTIS CSCL 04/2

During July 1972, laser radar (lidar) observations were made by Stanford Research Institute in support of a thermal fog dissipation program conducted by the Air Force at Vandenberg AFB. The program was designed to test the merging heat plume concept as a practical and efficient method of warm-fog dispersal. The ground-based heating system consisted of 213 liquid propane burners arranged in four lines perpendicular to the prevailing wind direction. The heat tests (conducted whenever fog reduced the horizontal visibility to less than 1/2 mile (800 m)) consisted to lighting various rows of burners at various burner intensities and spacings under various meteorological conditions (primarily wind speed variations). Profiles of atmospheric backscatter vs. range were observed with a ruby lidar at a point downwind from the ground-based heating system by firing every three seconds while scanning in a vertical plane normal to the wind. The observations are described and discussed in terms of their significance to demonstrating the operational feasibility of using lidar to document fog modification. (Author Modified Abstract) GRA

N73-25683# Manchester Univ. (England). Dept. of Physics.

THE ROLE OF ELECTRICAL FORCES IN THE DEVELOPMENT AND DISSIPATION OF CLOUDS AND FOGS Final Technical Report

John Latham and Michael H. Smith Dec. 1972 41 p refs

(Contract DAJA37-72-C-1967; DA Proj. 2M0-61102-B-53)

(AD-758925; ARDG(E)-E-1430) Avail: NTIS CSCL 04/2

The report is concerned with the work on the influence of electric forces upon the collection efficiency of water drops which fall through clouds of smaller droplets. A brief note of another research topic undertaken during the contract year is concerned with the effect of collisions and evaporation of raindrops below cloud base upon the resultant spectrum and its radar echo intensity. (Author Modified Abstract) GRA

N73-25684# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

THE 13501 HONEST JOHN MISSILE NO. 359, ROUND NO. 629 ROL, (16 FEBRUARY 1973) Meteorological Data Report

16 Feb. 1973 28 p

(DA Proj. 1T6-65702-D-127)

(AD-758862; DR-766) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 13501 Honest John, Missile Number 359, Round Number 629 ROL, are presented in tabular form. Author (GRA)

N73-25685# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

THE 03702 HONEST JOHN MISSILE NO. 627, ROUND NO. 632 AML, (3 APRIL 1973) Meteorological Data Report

Apr. 1973 24 p

(DA Proj. 1T6-65702-D-127)

(AD-758868; DR-771) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 03702 Honest John, Missile Number 627, Round Number 632 AML, are presented in tabular form. Author (GRA)

N73-25686# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

THE 03702 HONEST JOHN MISSILE NO. 1002, ROUND NO. 630 AML, (5 MARCH 1973) Meteorological Data Report

Mar. 1973 21 p

(DA Proj. 1T6-65702-D-127)

(AD-758865; DR-768) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 03702

Honest John, Missile Number 1002, Round Number 630 AML, are presented in tabular form. Author (GRA)

N73-25687# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11604 LANCE, MISSILE NO. 2237, ROUND NO. 185 RCL, (27 FEBRUARY 1973) Meteorological Data Report
27 Feb. 1973 43 p
(DA Proj. 1T6-65702-D-127)
(AD-758864; DR-767) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11604 Lance, Missile Number 2237, Round Number 185 RCL, are presented in tabular form. Author (GRA)

N73-25688# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
CLIMATIC ENVIRONMENT OF THE EAST SLOPE OF THE COLORADO FRONT RANGE Final Report
Roger G. Barry 1972 208 p refs
(Grant NSF GA-15528)
(PB-214341/0; INSTAAR-OP-3-72) Avail: NTIS HC $3.00 CSCL 04B

Climatic data for 1952 to 1970 collected at four stations at ridge sites on the east slope of the Front Range in Colorado (40 degrees N, 105 degrees W) between 7,200 and 12,300 ft. are analyzed using an information retrieval system (TAXIR). The principal results show: (1) no significant change in annual totals of solar radiation between 8,500 and 12,300 ft., (2) annual precipitation increases from about 22 in. at 7,200-8,500 ft. to 40 in. at 12,300 ft., and (3) there is a decreasing difference with elevation between temperatures at sites with different exposure. Temperature records were also examined with respect to time trends, return periods and the possible occurrence of singularities. Author (GRA)

N73-25689# Sperry Rand Research Center, Sudbury, Mass.
THERMASONDE DATA PROCESSING TECHNIQUES Final Report
W. D. Mount, A. C. Anway, B. R. Fow, C. M. Maloy, and C. V. Wick Oct. 1972 114 p refs
(Contract EPA-71-26)
(PB-214184/4; SRRC-CR-72-5; EPA-R3-72-022) Avail: NTIS HC $3.00 CSCL 04B

A study was conducted in which three data processing techniques developed under the previous contract were refined and tested on a small sample of simulated and observed radiometric data. The report is organized as follows: Section 2 is devoted to the simulation discrepancy. The present state of the art for the simulating the observed antenna temperatures and the impact of this capability upon system performance is discussed. Section 3 describes the data processing techniques. Specific work preformed in developing each technique is discussed. Section 4 discusses the effects of a non ideal antenna pattern, with a detailed description of a method of formulating the analysis of these effects. Sections 5 contains the conclusions derived from this work and their implications. Author

N73-25690# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONADIABATIC OPERATIONAL SCHEME FOR A SHORT-TERM WEATHER FORECAST
V. P. Dymnikov, G. R. Kontarev, G. M. Vinogradova, and L. E. Kaminskaya 18 Apr. 1973 16 p refs Transl. into ENGLISH from Chislennyi Prognoz i Teoriya Klimata (USSR), no. 272, 1972 p 15-23
(FTD Proj. T47-01-56)
(AD-759631; FTD-HT-23-183-73) Avail: NTIS CSCL 04/2

An attempt was made to use a baroclinic nonadiabatic atmospheric model for short term weather forecasts. Differential equations and a system of x, y, p, and t, coordinates are used to obtain solutions to the model. E.H.W.

N73-25691# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
TIME SERIES ANALYSIS OF SOUTHWEST MONSOON DATA FROM SOUTHEAST ASIA Interim Report
James T. Bunting 29 Jan. 1973 24 p refs
(AF Proj. 6698)
(AD-759788; AFCRL-AFSIG-256; AFCRL-TR-73-0085) Avail: NTIS CSCL 04/2

Data from Southeast Asia during the summer monsoons of 1967 and 1968 were studied by time series analysis. Spectral peaks corresponding to a period of about 5 days were found in radar data and in the meridional wind below 500 mb. The cross-spectra of meridional winds between pairs of stations suggested a westward propagation of waves over Southeast Asia with a period of approximately 5 days. Studies by others have revealed similar peaks in the meridional wind over the equatorial Pacific and have related these to westward propagating waves. Even though the summer monsoon differs greatly from the circulation in the equatorial Pacific, both have a tendency for oscillation at a period near 5 days and may be influenced by the same waves. (Author Modified Abstract) GRA

N73-25692# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE OF THE DIFFERENCE SYSTEMS FOR A NUMERICAL SOLUTION OF THE WEATHER FORECAST PROBLEM
V. F. Kim 18 Apr. 1973 16 p refs Transl. into ENGLISH from Chislennyi Prognoz Pogody i Teoriya Klimata (USSR), no. 272, 1972 p 79-87
(AD-759620; FTD-HT-23-186-73) Avail: NTIS CSCL 04/2

A splitting method is examined for use in numerical weather forecasting for a system that combines Adams-Bashfort systems and a natural filter. Problems of approximation and stability are analyzed in a simple atmospheric model. A typical problem is solved on a sphere covered by a uniform grid at one hour intervals for a five-day period. F.O.S.

N73-25693# Naval Weapons Center, China Lake, Calif.
PHASE 3, PROJECT GULF Q, A CHARACTERIZATION OF MARITIME CUMULUS CLOUDS
Edward E. Hindman, II, Richard W. Evert, and Richard S. Clark Feb. 1973 46 p refs
(AD-759368; NWC-TP-5457) Avail: NTIS CSCL 04/2

Phase III of Project Gulf Q was conducted from 24 May through 18 June 1971 at Brownsville, Texas. The primary objectives were to (1) characterize warm cumulus clouds and the meteorological conditions which cause them to form, (2) gather data for use in developing warm cumulus computer simulation models, and (3) document the effects of modifying warm cumulus clouds with hydrophilic and hydrophobic powders. (Author Modified Abstract) GRA

N73-25694# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HANDBOOK ON CLIMATE OF THE USSR,
S. A. Izyumenko, E. G. Rogovskaya, and M. I. Brainina 14 Mar. 1973 206 p refs Transl. into ENGLISH from Spravochnik Klimatu (USSR), v. 5, no. 24, 1968 p 1-296
(AD-759244; FTD-HT-23-26-73) Avail: NTIS CSCL 04/2

The report discusses cloud cover, fog, snowstorms, thunderstorms, and hail as recorded at weather stations in the U.S.S.R. GRA

N73-25695# Naval Electronics Lab. Center, San Diego, Calif.
METEOROLOGICAL PROCESSES AND FM-CW RADAR SOUNDINGS IN THE BOUNDARY LAYER Research and Development Report, Jul. 1971 - Jun. 1972
V. R. Noonkester, D. R. Jensen, and J. H. Richter 5 Feb. 1973 44 p refs
(AD-759019; NELC-TR-1862) Avail: NTIS CSCL 04/2

The development of the FM-CW radar as a meteorological forecast aid is advanced by an echo coding technique, breaking-wave statistics, convection and cloud-top monitoring capability, and a scanning mobile FM-CW radar. Author (GRA)

N73-25696# California Univ., Berkeley. Radio Astronomy Lab.
A FOUR CHANNEL RADIOMETER FOR REMOTE SENSING OF ATMOSPHERIC STRUCTURE Final Report, 1 Sep. 1970 - 1 Sep. 1972
William J. Welch Dec. 1972 20 p
(Contract F19628-71-C-0057; AF Proj. 8682)
(AD-759535; AFCRL-TR-73-0112) Avail: NTIS CSCL 04/2

The report describes a 4-channel radiometer system built to measure the intensity of microwave emission from atmospheric

oxygen and water vapor. The 4 channels are at 22, 51, and 59 GHz. From such measurements, the profiles of humidity and temperature in the lowest 10 kilometers of the atmosphere may be inferred. Outputs from the 4 channels are recorded continuously. The system has internal calibration sources which are automatically switched to the radiometer inputs at regular intervals. External absolute calibration black bodies are available for periodic calibration of the internal sources. Considerable effort has gone into stabilizing the internal calibration and the radiometer operating frequencies. The operation and calibration of the instrument is discussed. Author (GRA)

N73-25697# Army Electronics Command, Fort Monmouth, N.J.
AN INVESTIGATION OF ERRORS INTRODUCED INTO METEOROLOGICAL CALCULATIONS THROUGH USE OF THE HYPSOMETRIC EQUATION
Walter B. Miller Apr. 1973 41 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-759489; ECOM-5481) Avail: NTIS CSCL 04/2

The nature of errors introduced into meteorological calculations through use of the hypsometric equation is discussed with particular regard to the error behavior of the rawinsonde. It is found that significant effects on wind velocity and variability studies are to be expected from this source. This investigation is the third in a study of the error behavior of the rawinsonde as it is used in the investigation of mesoscale variability. Author (GRA)

N73-25698# Texas Univ., Austin. Electronics Research Center.
APPLICATION OF ADAPTIVE ESTIMATION TO TEMPERATURE FORECASTING
Newton B. Penrose and Demetrios G. Lainiotis 5 Dec. 1972 154 p refs
(Contract F44620-71-C-0091; Grant AF-AFOSR-1764-69; AF Proj. 4751)
(AD-759546; TR-140; AFOSR-72-2185TR) Avail: NTIS CSCL 04/2

The work is an application of adaptive estimation to temperature forecasting. It is presented as a feasibility study demonstrating the efficacy of the adaptive approach. The local station temperature forecasting problem is chosen to focus the discussion on the efficiency of the filtering algorithm by using only surface level single geographic location data. A diagnostic study is made to ascertain the appropriate statistical properties of the weather data for algorithm selection. A phenomenalistic approach is taken since no differential equation or complete quantitative description exists to describe the temperature process. The Lainiotis Filter is chosen for model identification and classification as well as prediction results. The Lainiotis Filter, given in the Partition Theorem, provides an efficient, powerful tool in the application of adaptive estimation techniques. The feasibility of the adaptive approach is established with comparative results with previous objective forecast methods while greatly reducing the amount and variety of required input data. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-25699 Stanford Univ., Calif.
IMPROVED NAVIGATION BY COMBINING VOR/DME INFORMATION WITH AIR OR INERTIAL DATA Ph.D. Thesis
John Charles Bobick 1972 154 p
Avail: Univ. Microfilms Order No. 72-30594

The primary navigation aid for civil aircraft is the VOR/DME system. Using VOR and DME measurements, bearing and range relative to a fixed ground station can be determined onboard the aircraft. Reductions in air traffic congestion and air controller workloads can be realized by combining VOR/DME information (from one or two stations) with data from an inertial navigation system by means of a maximum likelihood filter. It was found that the addition of air data to the information from two VOR/DME stations yields large factors of improvement in RMS position accuracy over the use of a single VOR/DME station, roughly 15 to 20 for the air data case and 25 to 35 for the inertial data case. Dissert. Abstr.

N73-25700# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AUTOMATED SELECTION OF VOR, ILS, AND TACAN/DME FREQUENCIES Final Report, Jan. 1965 - Feb. 1972
T. Steger and R. Johnson May 1973 75 p
(FAA-NA-73-4; FAA-RD-73-53) Avail: NTIS HC $5.75

A computer program developed to automate the selection of VOR, ILS, and Tacan/DME frequencies is presented. It includes a thumbnail sketch of the need for such a capability and describes: the program logic involved for this problem; the advantages of automatic frequencies selection in general; and some possible future applications. The results of an operational evaluation are highlighted and among other conclusions it was concluded the complete program offers a savings in time with no sacrifice in accuracy. Author

N73-25701# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary, 1 Jan. - 31 Mar. 1973
1 Apr. 1973 115 p refs
(Contracts DOT-FA72WAI-261; F19628-73-C-0002)
(FAA-RD-73-48) Avail: NTIS HC $7.75

Development of a Discrete Address Beacon System (DABS) is reported. Included in the report are brief reviews of: DABS link design modulation and interference studies; transponder design-cost studies; ATCRBS transponder tests; transponder antenna/airframe pattern measurements; and sensor monopulse antenna-processor studies. Also included are the results of studies pertaining to: interrogation scheduling the rotating antenna equipped sensor; aircraft tracking/correlation at the sensor and at the SCP; protocol for extended length messages; use of DABS sensors in various system configurations; Synchro-DABS scheduling constraints; and sensor netting and siting. A status report on the implementation of the Lincoln Laboratory DABS Experimental Facility and a review of planned direction finding experiments is included. Author

N73-25702# National Aviation Facilities Experimental Center, Atlantic City, N.J.
THE 1972 SEMINAR ON OPERATIONAL PROBLEMS OF THE AIR TRAFFIC CONTROL RADAR BEACON SYSTEM
Apr. 1973 257 p Seminar held at Atlantic City, 8-11 Feb. 1972
(FAA-NA-72-80) Avail: NTIS HC $15.00

The proceedings of a conference on the operational problems of the air traffic control beacon system are reported. The subjects discussed are: (1) problems of broken targets in display devices, (2) emergency false alarm difficulties, (3) electromagnetic interference, (4) false targets, and (5) missing and fading targets. Recommendations to control or eliminate the air traffic control problems are included. Author

N73-25703# Federal Aviation Administration, Washington, D.C. Office of Systems Research and Development Service.
ENGINEERING AND DEVELOPMENT PLAN: PERFORMANCE ASSURANCE
May 1973 32 p
(FAA-ED-21-2) Avail: NTIS HC $3.75

The development activities that are being pursued to enhance overall performance assurance of all air traffic control and navigation facilities within the National Airspace System (NAS) are described. The plan provides detailed information on the objectives, goals, program structure, technical approach, resources, and possible implementation, as well as, general discussions which emphasize the rationale and philosophy which dictates the course of action. This plan is indicated on the basic assumption that improvements and efficiencies in the current methods and concept of facility performance assurance are imperative in the face of continuing facility expansion, maintenance workforce freezes and economy drives. Author

N73-25704*# Kanner (Leo) Associates, Redwood City, Calif.
METHODS FOR CALCULATING THE NAVIGATION INFORMATION FOR MARS SPACECRAFT
P. E. Elyasberg, N. G. Aleksashin, and N. G. Khavenson Washington NASA May 1973 23 p refs Transl. into ENGLISH from Russian report
(Contract NASw-2481)
(NASA-TT-F-14897) Avail: NTIS HC $3.25 CSCL 17G

Methods used to calculate navigation parameters for interplanetary Mars spacecraft are discussed. The methods are based on the numerical integration of the differential equations of motion of the spacecraft. To calculate the position of celestial bodies, Newcomb expansions are used in the case of planets and polynomials based on Brown's theory in the case of the moon. The methods can be used for navigational calculations of any interplanetary spacecraft in the Earth-Mars or Earth-Moon space. Author

N73-25705# Champlain Technology, Inc., West Palm Beach, Fla.
VERTICAL AREA NAVIGATION SYSTEM ANALYSIS Final Report
E. H. Bolz and E. D. McConkey Sep. 1972 180 p refs
(Contract DOT-FA72WA-2831)
(FAA-RD-72-125) Avail: NTIS HC $11.00

An analysis and digital computer simulation of the operational and performance aspects of vertical area navigation (VNAV) systems is presented. A sensitivity analysis was performed relating each of the various error elements of various levels of VNAV system complexity and cost to the overall system use accuracy. A parallel investigation was made of the procedural and operational impacts of several categories of user aircraft operating under a variety of external environmental conditions. Author

N73-25706*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SPACE SHUTTLE GN AND C EQUATION DOCUMENT NO. 20: FINE ALIGNMENT GYRO TORQUING ANGLES
Joseph St.Amand Sep. 1972 20 p
(Contract NAS9-10268)
(NASA-CR-128964; T73-14254) Avail: NTIS HC $3.00 CSCL 17G

The procedure for aligning the inertial reference unit of the space shuttle by celestial references is discussed. The gyro torquing angles required to go from the present stable member to the desired stable member are determined. The inputs are the transformation matrix from the reference to the desired stable member coordinates and the unit vectors to the two target stars in both the reference and present stable member coordinates. The equations involved in establishing the reference are developed. Author

N73-25707*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SPACE SHUTTLE GN AND C EQUATION DOCUMENT NO. 22: APPROACH GUIDANCE
Yee-Chee Tao Dec. 1972 31 p refs
(Contract NAS9-10268)
(NASA-CR-128962; T73-14252) Avail: NTIS HC $3.25 CSCL 17G

The approach guidance routine for taking the space shuttle orbiter vehicle from the end of the entry phase altitude of approximately 100,000 feet to the start of the terminal guidance phase is presented. The guidance routine consists of six modes: (1) acquisition, (2) energy dissipation, (3) turn in, (4) initial approach, (5) heading alignment, and (6) final approach. Diagrams of the flight path for the various modes are included. Equations of motion governing the performance of the vehicle during each mode are developed. Author

N73-25708*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SPACE SHUTTLE GN AND C EQUATION DOCUMENT NO. 21: SHUTTLE UNIFIED NAVIGATION FILTER
Eugene S. Muller, Jr. Nov. 1972 95 p refs
(Contract NAS9-10268)
(NASA-CR-128961; T73-14253) Avail: NTIS HC $6.75 CSCL 17G

The space shuttle navigation equations are presented in a form for a single unified navigation filter used in each mission phase. The document serves as a single reference for the navigation equations replacing each of the individual mission phase navigation documents previously published. The fundamental characteristics of the navigation filter are described. The features of the unified formulation of the filter are analyzed. Author

N73-25709*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SPACE SHUTTLE GN AND C EQUATION DOCUMENT NO. 23: ENERGY DISSIPATION RATE GUIDANCE FOR APPROACH PHASE
Antonio Elias Jan. 1973 22 p ref
(Contract NAS9-10268; DSR Proj. 55-40800)
(NASA-CR-128960; T73-14251) Avail: NTIS HC $3.25 CSCL 17G

The approach guidance routine for taking the space shuttle orbiter from the entry phase of approximately 100,000 feet to the start of the final landing maneuver is discussed. The approach guidance system is a closed feedback loop scheme. The vehicle energy is managed by controlling the rate at which energy is dissipated during a straight in approach. The spacecraft performance during each segment of the approach flight is analyzed. Equations of motion are developed to describe the spacecraft guidance and flight path. Author

N73-25710*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PILOT'S MANUAL FOR AUTOMATED 4D GUIDANCE SYSTEM
Heinz Erzberger and Thomas Pecsvaradi Apr. 1973 43 p refs
(NASA-TM-X-62233) Avail: NTIS HC $4.25 CSCL 17G

Operational procedures and modes of an experimental 4D guidance system are described from the pilot's point of view. The system consists of the experimental avionics equipment referred to as STOLAND and a specially developed software package for the STOLAND digital computer. A capture mode of the system provides arrival time control and automatic tracking of the 4D flight path from any feasible initial aircraft state to any waypoint. Precise arrival time at a waypoint is achieved by means of speed control or, if large delays are required, by path stretching. Continuous recomputation and display of the capture flight path prior to engaging the system permits the pilot to determine the exact moment for terminating a holding or path stretching maneuver in order to achieve a specified arrival time. Author

N73-25711# Royal Aircraft Establishment, Farnborough (England).
A COMPREHENSIVE AIRPORT COMMUNICATION SYSTEM (CACS): FEASIBILITY STUDY
M. E. Smith Nov. 1972 93 p
(RAE-TR-72133; BR-32587) Avail: NTIS HC $6.75

A survey was conducted of the need for computer-based data communications and/or processing facilities at a major civil airport. This survey revealed an imbalance in the current development of such facilities within civil aviation which is to the detriment of the airport and which, if not redressed, will limit the advantage to be derived from those facilities already in operation or under development. A proposal is made for a system comprising data communication and processing facilities that is intended to enable the airport to participate fully in future developments of civil aviation automation. The proposal is made in varying depth for the various aspects of the overall system: great consideration was given to the requirements of the airport ATC where the need for improved communications is thought to be the most pressing. Author (ESRO)

N73-25712# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
EFFECT OF AN ADDITIONAL HEIGHT MEASUREMENT ON THREE-DIMENSIONAL POSITION FIXING USING LOW ORBITING NAVIGATION SATELLITES [DER EINFLUSS EINER ZUSAETZLICHEN HOEHENMESSUNG AUF DREI-DIMENSIONALE STANDORTBESTIMMUNGEN MIT HILFE UMLAUFENDER NAVIGATIONSSATELLITEN]

Helge Haensel and Otto Weber 1973 57 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-28) Avail: NTIS HC $5.00; DFVLR, Porz, West Ger. 13,50 DM

The three-dimensional position-fixing using satellites of the Navy Navigation Satellite System and the accuracy improvement which can be obtained by an additional measurement of the height of the receiving antenna with respect to the earth ellipsoid is discussed. The equations for the displacement of the position and for the improvement of the error ellipsoid are derived as a function of the following data: (1) the parameters of the original Doppler-system, (2) the standard deviation, and (3) the value of the additional height measurement. The effect of an additional height measurement on actual Doppler-measurements at Braunschweig is demonstrated for two particularly unfavorable satellite passages and for a sample of 33 passages. An improvement in accuracy of more than one order is possible. The statistical methods described are also applicable to other navigation systems. Author (ESRO)

N73-25713# Boeing Commercial Airplane Co., Seattle, Wash.
CONTROL-DISPLAY TESTING REQUIREMENTS STUDY, VOLUME 1 Final Report, 24 Jan. - 24 Aug. 1972
D. L. Parks, D. M. Fadden, and J. R. Fries Wright-Patterson AFB, Ohio AFFDL Jan. 1973 184 p refs
(Contract F33615-72-C-1663; AF Proj. 404L)
(AD-758791; D6-60162-Vol-1; AFFDL-TR-121-Vol-1) Avail: NTIS CSCL 17/7

Control-display test development requirements are defined for the microwave landing system portion of the Air Force Advanced Landing System Program. Included are individual test plans, a test integration plan, and program schedules. The approach to deriving test requirements is outlined, including results of surveys and analyses covering the microwave landing system, Air Force users, and landing display systems, and the system analyses to define basic data requirements and to collate system user data based on functional flows and action-information requirements. Details of plan development and supporting data are presented as reference material for use in subsequent test design and test program conduct and for trade data to support on-line decisions. Author (GRA)

N73-25714# Boeing Commercial Airplane Co., Seattle, Wash.
CONTROL-DISPLAY TESTING REQUIREMENTS STUDY, VOLUME 2 Final Report, 24 Jan. - 24 Aug. 1972
D. L. Parks, D. M. Fadden, and J. R. Fries Wright-Patterson AFB, Ohio AFFDL Jan. 1973 131 p refs
(Contract F33615-72-C-1663; AF Proj. 404L)
(AD-758792; D6-60162-1-Vol-2; AFFDL-TR-121-Vol-2) Avail: NTIS CSCL 17/7

As an appendix to volume 1 of the Control-Display Testing Requirements Study, the report contains two appendixes relevant to control-display-pilot factor testing for the Air Force in the Microwave Landing System (MLS) Program: Appendix I--Facilities: Facility resource summaries covering resources available or negotiable for Air Force use in the MLS test program, and Appendix 2--Derivation of Action-Information Requirements: These requirements are based on a systems analysis covering approach functions, required actions, and resulting information requirements. Author (GRA)

N73-25715# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE ROLE OF AN AIRBORNE TRAFFIC AND SITUATION DISPLAY IN THE EVOLVING ATC ENVIRONMENT
Richard W. Bush and Herbert G. Weiss 1 May 1973 363 p refs
(Contract CON-AAC-71-02)
(PB-215714/7) Avail: NTIS HC $9.00 CSCL 17G

The report summarizes the results of a study to investigate the role of an Airborne Traffic and Situation Display (ATSD) in the evolving air traffic control environment. While the concept of displaying traffic information in the cockpit has been under discussion for more than two decades, only in recent years has it been possible to provide an aircraft-centered display of pertinent information with acceptable quality and cost. The Aviation Advisory Commission initiated this study to determine if the performance of the overall ATC system would be enhanced by permitting a pilot with an ATSD to participate more effectively in the ATC function. Author (GRA)

N73-25716# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NAVIGATION SCHEMES FOR LES-8/9 AUTONOMOUS STATIONKEEPING SYSTEM
Sushanta Srivastava 20 Apr. 1973 28 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-759806; TN-1973-18; ESD-TR-73-85) Avail: NTIS CSCL 17/7

The autonomous stationkeeping system for LES-8/9 controls the mean longitude of the satellite by on board navigation. The longitude is computed from the observations of an infrared earth-horizon scanner, sun azimuth transit sensors and an earth-shadow sensor. The compensation for non-uniform sun motion for any near ecliptic satellite orbit is generated by an ephemeris synthesizer. The time reference is obtained from a stabilized oscillator. The report describes various considerations for the design of the navigation scheme. Author (GRA)

N73-25717# Naval Observatory, Washington, D.C.
PROCEEDINGS OF THE ANNUAL DEPARTMENT OF DEFENSE PRECISE TIME AND TIME INTERVAL (PTTI) STRATEGIC PLANNING MEETING (THIRD)
1973 434 p refs Conf. held at Washington, D. C., 16-18 Nov. 1971
(AD-758739) Avail: NTIS CSCL 17/7

The Third Annual Department of Defense (DOD) Precise Time and Time Interval (PTTI) Strategic Planning Meeting, sponsored by the U.S. Naval Observatory was held November 16-18, 1971 in Washington, D.C., to accomplish the following objectives: exchange of practical information associated with PTTI, review present and future requirements for PTTI, review status of current and planned systems for PTTI dissemination, acquaint systems engineers and/or managers with precise time and frequency technology and its problems. This report contains a summary of PTTI topics discussed during the 16-18 November 1971 meeting. The unclassified Conference Proceedings are contained in this volume. GRA

N73-25718# Naval Research Lab., Washington, D.C. Electromagnetic Propagation Branch.
OMEGA IN THE ARCTIC Interim Report
John W. Brogden Apr. 1973 18 p refs
(AD-759009; NRL-MR-2575) Avail: NTIS CSCL 17/7

The Federal Aviation Administration (FAA) is sponsoring a program at the Naval Research Laboratory to investigate the effects of polar cap absorption events (PCA), and other propagation anomalies, on the Omega Navigation System when used in the high latitude regions. There is interest by FAA in this area because of the so-called polar routes of the commercial air lines. Preliminary results presented show the effects of two PCA events. One of these produced a phase advance of 50 CELS for the 10.2 kHz Norway-Hawaii transmissions as received in Washington, D.C. (Author Modified Abstract) GRA

N73-25719# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ANALYSIS OF DATA RATE REQUIREMENTS FOR LOW VISIBILITY APPROACH WITH A SCANNING BEAM LANDING GUIDANCE SYSTEM Technical Report, Aug. 1969 - 1 Jul. 1972
James D. Dillow, Paul R. Stolz, and Meyer D. Zuckerman Feb. 1973 173 p refs
(AF Proj. 8219)
(AD-758786; AFFDL-TR-71-177) Avail: NTIS CSCL 17/7

Data rate requirements for low visibility approach with a sample data measurement of glideslope deviation are investigated analytically. A window is defined by specifying certain allowable deviations in the aircraft motion variables which are acceptable for continuation of the landing at a 100-ft-decision altitude. The approach performance is defined as the probability of missing the window, which corresponds to the probability of a missed approach. The landing approach process is modeled by a system of stochastic differential equations, which account for the aircraft dynamics, atmospheric disturbances, guidance errors, and data rate. The flight control system is modeled by a state estimator and a state feedback matrix which is optimized so as

to minimize the probability of a missed approach subject to rms constraints on control activity. (Author Modified Abstract) GRA

N73-25039 Ministry of Aviation, London (England).
PRINCIPLES OF ATTITUDE CONTROL OF ARTIFICIAL SATELLITES
N. E. Ives *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1287-1307 Previously issued as RAE-TN-GW-534; ARC-21963 (For availability see N73-25020 16-01)
(ARC-R/M-3276; RAE-TN-GW-534; ARC-21963)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-25720*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FAST-SPECTRUM SPACE-POWER-REACTOR CONCEPTS USING BORON CONTROL DEVICES
Wendell Mayo Washington Jun. 1973 33 p refs
(NASA-TM-X-2821; E-7354) Avail: NTIS HC $3.00 CSCL 18I

Several fast-spectrum space power reactor concepts that use boron carbide control devices were examined to determine the neutronic feasibility of the designs. The designs considered were (1) a 199-fuel-pin, 12-poison-reflector-control-drum reactor; (2) a 232-fuel-pin reactor with 12 reflector drums and three in-core control rods; (3) a 337-fuel-pin design with 12 incore control rods; and a 181-fuel-pin design with six drums closely coupled to the core to increase reactivity per drum. Adequate reactivity control and excess reactivity could be obtained for each concept, and the goals of 50,000 hours at 2.17 thermal megawatts with a lithium-7 coolant outlet temperature of 1222 K could be met without exceeding the 1-percent-clad-creep criterion. Heating rates in the boron carbide were calculated, but a heat transfer analysis was not done. Author

N73-25721*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
ANALYSIS OF TEMPERATURE AND PRESSURE DISTRIBUTION OF CONTAINERS FOR NUCLEAR WASTE MATERIAL DISPOSAL IN SPACE Final Report
L. E. VanBibber and W. G. Parker Apr. 1973 111 p refs
(Contract NAS3-16819)
(NASA-CR-121186; WANL-FR-NAS3-16819-8) Avail: NTIS HC $7.75 CSCL 18G

A computer program was adapted from a previous generation program to analyze the temperature and internal pressure response of a radioactive nuclear waste material disposal container following impact on the earth. This program considers component melting, LiH dissociation, temperature dependent properties and pressure and container stress response. Analyses were performed for 21 cases with variations in radioactive power level, container geometry, degree of deformation of the container, degree of burial and soil properties. Results indicated that the integrity of SS-316 containers could be maintained with partial burials of either underformed or deformed containers. Results indicated that completely buried waste containers, with power levels above 5 kW, experienced creep stress rupture failures in 4 to 12 days. Author

N73-25722*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EVOLUTIONARY APPROACH FOR A COMPACT-SPLIT-CORE REACTOR
Roland Breitwieser and Edward Lantz 1973 28 p refs Presented at the Am. Nucl. Soc., Chicago, 11-15 Jun. 1973
(NASA-TM-X-68254; E-7533) Avail: NTIS HC $3.50 CSCL 18I

An economical approach for advanced reactor power development is presented, and systems that result from the several stages of this plan are described. The development starts with a highly modularized heat pipe, radioisotopic design and evolves into a low specific weight high performance reactor system. Author

N73-25723*# McDonnell-Douglas Astronautics Co., Richland, Wash.
ELECTRODES FOR THE THERMIONIC CONVERTERS, PHASE 2 - 3 Final Report
J. G. DeSteese Dec. 1972 51 p refs Prepared for JPL
(Contract NAS7-100; JPL-953125)
(NASA-CR-131838; MDC-G4401) Avail: NTIS HC $4.75 CSCL 10B

The characteristics of electrodes for thermionic converters are discussed. A metal/ceramic Marchuk tube was constructed and operated with a quiescent cesium vapor plasma corresponding to cesium liquid reservoir temperatures from 376 to 427 K. The work function characteristics of tantalum test emitters coated with anodic films were measured to evaluate the applicability of the materials as the collector surface in a plasma mode thermionic converter. Work function minimum values between 1.4 and 1.5 electron volts were observed. The effect of the electronegative surface layers was partially obscured by additive vapor impurities detected by the clean tantalum reference emitter. Author

N73-25724*# McDonnell-Douglas Astronautics Co., Richland, Wash.
FEASIBILITY STUDY OF OXYGEN-DISPENSING EMITTERS FOR THERMIONIC CONVERTERS, PHASE 1 Final Report
J. G. DeSteese May 1972 51 p refs Prepared for JPL
(Contract NAS7-100; JPL-953125)
(NASA-CR-131837; MDC-G3144) Avail: NTIS HC $4.75 CSCL 10B

A metal/ceramic Marchuk tube was used to measure work functions of oxygen-doped tantalum, to determine applicability of the material to plasma-mode thermionic converters. Oxygen-doped tantalum was shown to increase in work function monotonically with oxygen doping in the range 0.1 to 0.3 atomic percent. Oxygenated test emitters were run at an average temperature of 2165 K and a T/T sub Cs ratio -5.8 to observe the influence of oxygen depletion. Bare work function decreased with outgassing of oxygen. Projections were made based on outgassing kinetics and area/volume ratios to calculate the longevity of oxygen doping in a practical converter. Calculations indicated that the program goal of 10,000 hr could be achieved at 1800 K with an initial oxygen doping of 1 atomic percent and a practical emitter area/volume ratio. Author

N73-25725*# Stanford Research Inst., Menlo Park, Calif.
A PILOT LEVEL DECISION ANALYSIS OF THERMIONIC REACTOR DEVELOPMENT STRATEGY FOR NUCLEAR ELECTRIC PROPULSION Final Report
Michael M. Menke and Bruce R. Judd May 1973 113 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953435; SRI Proj. MSD-2006)
(NASA-CR-133035) Avail: NTIS HC $7.75 CSCL 21F

The development policy for thermionic reactors to provide electric propulsion and power for space exploration was analyzed to develop a logical procedure for selecting development alternatives that reflect the technical feasibility, JPL/NASA project objectives, and the economic environment of the project. The partial evolution of a decision model from the underlying philosophy of decision analysis to a deterministic pilot phase is presented, and the general manner in which this decision model can be employed to examine propulsion development alternatives is illustrated. Author

N73-25726*# Atomics International, Canoga Park, Calif.
MATERIALS INTERACTIONS BETWEEN THE THERMOELECTRIC CONVERTER AND THE 5kwe REACTOR SYSTEM
P. B. Ferry 30 Jun. 1973 72 p refs
(NASA Order C-21029-C; NASA Order C-21030-C; Contract AT(04-3)-701)
(NASA-CR-121230; AI-AEC-13102) Avail: NTIS HC $5.75 CSCL 10B

The integration of a compact thermoelectric converter with a 5-kwe reactor system is described. Material interaction uncertainties study is also presented. This includes degradation

of the required austenitic - refractory metal transition joint during operation at high temperatures; loss of corrosion resistance; embrittlement by the presence of hydrogen; and loss of design margin by transport of interstitial elements. Analysis and limited experimental evidence indicate that these potential materials interactions can be adequately controlled. Group 5-2 refractory metals can be utilized without unacceptable adverse effect on system reliability. Author

N73-25727# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
WEAR CHARACTERISTICS OF MATERIAL COMBINATIONS IN LIQUID SODIUM
E. Wild, K. J. Mack, and G. Drechsler Nov. 1972 64 p refs
In GERMAN; ENGLISH summary
(KFK-1659) Avail: AEC Depository Libraries

Investigations of reactor materials wear behavior require experimental facilities that provide for simulation of operating conditions existing in the components of sodium cooled reactor facilities. Highly sensitive instruments are used to measure the sometimes minor changes of shape of material specimens caused by wear. An experimental facility is described along with measuring and safety devices for carrying out wear tests in sodium up to 6000 C. Experimental results obtained before June 1972 are discussed and tabulated. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-25728 Michigan Univ., Ann Arbor.
LIQUID HELIUM EXPERIMENTS WITH MICRON-SIZE ORIFICES Ph.D. Thesis
George Louis Schofield, Jr. 1972 99 p
Avail: Univ. Microfilms Order No. 72-29195

A completely sealed experimental cell at HE3 temperatures was employed to investigate the analog of the ac Josephson effect in superfluid helium, and to study superfluid critical velocities. The cell consisted of two reservoirs, each in the form of a coaxial capacitor, connected only by a micron size orifice. Differences in the liquid levels in the two reservoirs and sound fields near the orifice are produced by subjecting the liquid in one of the reservoirs to dc and ac electric fields. Level changes and flow through the orifice at critical velocities could be produced by applying a dc voltage step function to the cell. Constant subcritical velocities could be produced by using a square-root-of-time voltage ramp. The ac and dc dielectric pumping was found to agree with theory except at certain values of the frequency, associated with acoustic resonances. The presence of the ac Josephson effect was never detected. Attempts to reproduce the Richards-Anderson experiment also failed. Dissert. Abstr.

N73-25729 California Inst. of Tech., Pasadena.
INFRARED OPTICAL PARAMETRIC FLUORESCENCE AND PARAMETRIC OSCILLATION Ph.D. Thesis
James Edward Pearson 1972 157 p
Avail: Univ. Microfilms Order No. 72-30828

The properties of optical parametric fluorescence and parametric oscillation are considered in detail. Parametric fluorescence occurs when a pump light source (usually a laser) is incident on a nonlinear crystal; an input pump photon is split into two new photons whose energies sum to that of the pump. For use in theoretical discussions, the nonlinear equations which describe three-wave parametric interactions are derived from Maxwell's equations. The interaction equations are given in a general form which exhibits the spatial and temporal dependence of the fields. The equations are solved for the case of a steady-state, non-depleted pump, parametric amplifier. The power, bandwidth, and angular dependence of parametric fluorescence are theoretically discussed in detail. Experimental measurements using a 1.06 micron, Nd:YAG laser are in good agreement with the theory. The experiments constitute the first observation of parametric fluorescence in the infrared. Dissert. Abstr.

N73-25730 Northwestern Univ., Evanston, Ill.
MICROSCOPIC CALCULATIONS FOR LIQUID HELIUM AND ADSORBED HELIUM MONOLAYERS Ph.D. Thesis
Hwa-Wen Lai 1972 152 p
Avail: Univ. Microfilms Order No. 72-32486

The dispersion of the phonon spectrum in liquid He-4 is defined by an ordering scheme for the expansion and computed to the second order. The ground state properties of liquid He-4 are studied by a variational procedure employing a trial wave function which incorporates three particle correlations into the Jastrow function. Finally, a quantum theory of physically adsorbed He monolayers is developed, it takes into account both the static potential provided by a model substrate and He-He interactions. Dissert. Abstr.

N73-25731 Stevens Inst. of Tech., Hoboken, N.J.
HIGH RESOLUTION BRILLOUIN SPECTROSCOPIC STUDY OF HYPERSONIC SOUND VELOCITY AND ATTENUATION AS A FUNCTION OF TEMPERATURE IN ACRYLIC MONOMERS Ph.D. Thesis
Aristotle Papayoanou 1972 186 p
Avail: Univ. Microfilms Order No. 72-31173

Acoustic velocity and attenuation in four acrylic monomer liquids (methyl acrylate, methyl methacrylate, ethyl methacrylate and cyclohexyl methacrylate) was measured with Brillouin spectroscopy over a maximum temperature interval between 0 and 95 C. Two relaxation mechanisms were found in the frequency and temperature range of the experiment. The first one appeared as a prominent peak near 30 C in all four liquids and was attributed to rotational isomerism. There is a hindered rotation of an ester side group about a carbon-carbon bond. The two isomeric states are at different energy levels and are thermally populated by an acoustic disturbance. The isomeric relaxation frequency was determined to be approximately 900 MHz. In the acrylic polymers the transition between states causes the beta relaxation. The second relaxation appears as an overall increase in the attenuation as the temperature is raised and represents an additional dynamical mechanism in the monomers. Dissert. Abstr.

N73-25732*# Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF MICROWAVE RADIATION FROM THE SATELLITE COSMOS 243 OVER AGRICULTURAL LANDSCAPE
G. M. Belyakova et al Washington NASA Jun. 1973 7 p ref Transl. into ENGLISH from Dokl. Akad. Nauk (Moscow), v. 201, no. 4, 1971 p 837-839
(Contract NASw-2481)
(NASA-TT-F-14952) Avail: NTIS HC $3.00 CSCL 20N

Results of microwave radiation studies over the European portion of the U.S.S.R. are studied. The objective is the determination of surface parameters in an area with planted crops. The measurement of radiation from the Cosmos 243 satellite and data on the temperature and humidity provided by the weather service were used. The European U.S.S.R. was selected because of the avilability of good cartographic material and weather data in that area. Author

N73-25733# Electrotechnical Lab., Tokyo (Japan).
ITINERANT ELECTRON MAGNETISM IN THE ZrZn2 PHASE
Shinji Ogawa Dec. 1972 47 p refs
(Rept-735) Avail: NTIS HC $4.50

Measurements of magnetization, paramagnetic susceptibility, forced magnetostriction, thermal expansion, and electron spin resonance were made on the intermetallic compound ZrZn2 and its alloys with transition metal element Zr1-x Mx Zn2. Theoretical results on the magnetic and thermal properties of a very weak itinerant electron ferromagnet based on the Stoner model are briefly reviewed. The comparison of experimental results with theoretical ones reveals that ZrZn2 is an almost ideal example of a very weak itinerant electron ferromagnet. Author

N73-25734*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL EVALUATION OF JET NOISE SOURCE

LOCATION TECHNIQUE UTILIZING AN ACOUSTICALLY HARD BAFFLE WITH APERTURE
Thomas D. Norum and Edward P. McDaid Washington Jun. 1972 24 p refs
(NASA-TN-D-7229; L-8739) Avail: NTIS HC $3.00 CSCL 20A

An analytical investigation was conducted on the experimental technique that uses shielding by an acoustically hard baffle to determine the location of noise sources in a jet. The jet exhausts through a circular hole in the baffle and the radiated acoustic power is considered to be generated by a distributed source along the jet axis. It is found that the effect of the baffle on the radiated power can be neglected only when the size of the source is on the order of a wavelength of the emitted sound or larger. Since noise sources in a jet are compact, the experimental technique is insufficient to identify these sources. Author

N73-25735# Human Engineering Labs., Aberdeen Proving Ground, Md.
MATERIAL DESIGN STANDARD FOR NOISE LEVELS OF ARMY MATERIAL COMMAND EQUIPMENT
Georges R. Garinther and David C. Hodge Sep. 1972 29 p
(AD-750649; HEL-Std-S-1-63C; Rept-73-01196) Avail: NTIS HC $3.50

The U.S. Army Materiel Command's design standard for noise is described. It establishes the acoustical noise levels permitted in and around all equipment designed, developed, and procured by AMC, and specifies the testing requirements and measurement techniques for determining conformance to the noise limits. The noise levels and test procedures of this standard are intended to cover typical operational conditions and are based on considerations of hazard to hearing, speech intelligibility, aural detection, and appropriate state and federal noise limits. Author

N73-25736# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
STUDY OF CHARACTERISTICS AND EVALUATION OF POSSIBLE USE OF ORTHOFERRITES Annual Report [ETUDE DE CARACTERISATION ET D'EVALUATION DES POSSIBILITIES D'EMPLOI DES ORTHOFERRITES RAPPORT DE FIN D'ANNEE]
TranVanKhai 20 Dec. 1971 8 p In FRENCH
(Contract DGRST-71-7-2670)
(LCR-71-232/1/R) Avail: NTIS HC $3.00

Magnetic materials with cylindrical domains were evaluated for application to magnetic circuits. Experimental methods were investigated in order to characterize magnetic cards with cylindrical domains. This characterization is looked at from a functional viewpoint. In particular, the mobility of domains and the topography of defects in cards were studied. Simple magnetic circuits were investigated with a view to their application to future devices: bubble generators, etc. Computer programs were developed to check certain experimental results, notably the mobility of a cylindrical domain around a permalloy disk, and mobility of a cylindrical domain in a classical permalloy propagator (T bar or Y bar). ESRO

N73-25737# Transportation Systems Center, Cambridge, Mass.
AMBIENT NOISE LEVEL MEASUREMENTS IN PROPOSED FLORIDA AIRPORT AREA Final Report
Robert W. Quinn Dec. 1972 106 p
(Contract DOT-OS-307)
(PB-214459/0; DOT-TSC-OST-72-19) Avail: NTIS HC $3.00 CSCL 13B

Measurement results made at ten locations near the three remaining sites being studied for the south Florida regional airport are reported. Tabulated data display a summary of the measured noise levels at each location expressed as noise levels exceeded 1, 10, 50, 90 and 99 percent of the time in A-weighted decibels. The standard deviation, minimum and maximum A-weighted levels are also tabulated. Author (GRA)

N73-25738# Transport and Road Research Lab., Crowthorne (England).
THE COMBINATION OF NOISE FROM SEPARATE TIME VARYING SOURCES
P. M. Nelson 1972 30 p
(PB-214250/3; TRRL-LR-526) Avail: NTIS HC $3.00 CSCL 20A

Two methods of combining time varying noise sources are proposed and the applications of these procedures to practical situations are discussed. A design method is suggested that enables both L sub 10 and L sub 90 values to be determined when two or more Gaussian traffic noise distributions are combined. It is indicated that the combination technique may be applied to various noise sources, e.g. the interaction of aircraft fly past and surface traffic noise. Author (GRA)

N73-25739# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A COMPILATION OF LUMINANCE DATA FOR INCORPORATING MULTIPLE SCATTERING INTO A RADIATIVE TRANSFER MODEL
Richard G. Reitz Mar. 1973 41 p refs
(DA Proj. 1T0-61102-B-11A)
(AD-758877; BRL-MR-2278) Avail: NTIS CSCL 04/1

A digital computer model to predict the spectral irradiance on a ground target is being developed at the Ballistic Research Laboratories. A preliminary model based on single scattering has been developed to predict the irradiance produced from the sun and the cloudless daytime sky. To provide a data base for the incorporation of multiple scattering into the model, the luminances of the sun and sky were measured as a function of geometric and environmental conditions. The report contains the data and describes the techniques used to obtain the data that will be used to incorporate the effect of multiple scattering into the model. Author (GRA)

N73-25740# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
DIGITAL SYSTEM FOR THE MEASUREMENT OF DIRECTIVITY INDEX Final Report
A. Mark Young 20 Apr. 1973 16 p refs
(RE11121403)
(AD-758639; NRL-7585) Avail: NTIS CSCL 17/1

An experimental system has been devised for measuring the directivity index of an underwater sound transducer in about 10 minutes, which represents a substantial improvement over the conventional measurement time of at least one hour. This system is designed to measure sound intensity over equal areas of a spherical surface at a fixed radius from the transducer and to calculate directivity index by means of a minicomputer. A seven-element semicircular array of receiving hydrophones provides data for every 10 degrees of azimuth angle. Results of system measurements on several USRD transducers that were within the design limits of the array compared favorably with those obtained by conventional methods and by theoretical predictions. Author (GRA)

N73-25741# Stanford Univ., Calif. Microwave Lab.
DEVELOPMENT OF TUNABLE INFRARED PARAMETRIC OSCILLATORS AND COHERENT TUNABLE SOURCE SPECTROSCOPY Annual Report, Mar. 1972 - Mar. 1973
R. L. Byer, R. L. Herbst, R. F. Begley, and S. Warshaw Apr. 1973 45 p refs
(Contract N00014-67-A-0112-0070)
(AD-759408; SU-ML-2161) Avail: NTIS CSCL 20/6

The purpose of the research performed under this program is to investigate and demonstrate tunable coherent infrared sources. The program consists of three parts; infrared generation in CdSe by parametric oscillation and by mixing, infrared generation in the new chalcopyrite nonlinear materials, and generation by stimulated Compton scattering (SCS). The first two parts of this program have been experimentally investigated with significant results demonstrated during the year. The third part of the program consists of a thorough theoretical study of the prospects for Stimulated Compton Scattering. GRA

N73-25742# Stanford Univ., Calif. Microwave Lab.
CdGeAs2 AND CdGeP2 CHALCOPYRITE MATERIALS FOR INFRARED NONLINEAR OPTICS Final Report, 1 Aug. 1970 - 31 Jul. 1972
Helge Kildal Wright-Patterson AFB, Ohio AFML Dec. 1972 185 p refs
(Contract F33615-70-C-1640; ARPA Order 1636)

(AD-759556; ML-2118; AFML-TR-72-277) Avail: NTIS CSCL 20/6

The work reports on new crystals for infrared nonlinear optics. The investigated crystals are II-IV-V2 semiconductor compounds with chalcopyrite structure. Both theoretical and experimental results are given on growth technique, material quality problems, and semiconducting properties that effect the optical properties. The linear and the nonlinear optical properties are discussed. The bandstructure of the chalcopyrites near the Brillouin zone center has been determined, and good agreement between the calculated and the measured intraband absorption in p-type CdGeAs2 was found. (Author Modified Abstract) GRA

N73-25743# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE CALCULATION OF THE MONOCHROMATIC ABSORPTION COEFFICIENT IN THE NARROW REGIONS OF THE OSCILLATORY-ROTATIONAL SPECTRUM OF H2O

I. I. Ippolitov, Yu. S. Makushkin, and A. A. Orlov 29 Mar. 1973 15 p refs Transl. into ENGLISH from the publ. "Trudy Mezhvuzovskogo Nauchnogo Soveshchaniya po Spektralnoy Prozrachnosti Atmosfery v Vidimoy i Infrakrasnoy Oblastyakh Spektra" Tomsk, Tomskogo Univ., 1968 p 30-46

(AD-759238; FTD-MT-24-1605-72) Avail: NTIS CSCL 07/4

In connection with the appearance of quantum generators of the optical range, the task of the calculation of the radiation absorption of lasers in the atmosphere becomes important. As is known, the basic absorbing component of the atmosphere in the infrared region of the spectrum is water vapor whose spectrum is characterized by the presence of a very large number of overlapped lines of absorption, which impedes the experimental analysis of the spectrum due to the finite resolution spectral instruments. This involves the detailed theoretical calculation of the monochromatic absorption coefficient for narrow spectral ranges. The report discusses the monochromatic absorption coefficient. GRA

N73-25744# Army Electronics Command, Fort Monmouth, N.J.

DETERMINATION OF THE OPTICAL ABSORPTION COEFFICIENT OF POWDERED MATERIALS WHOSE PARTICLE SIZE DISTRIBUTION AND REFRACTIVE INDICES ARE NOT KNOWN

James D. Lindberg and David G. Snyder Apr. 1973 29 p refs

(DA Proj. 1T0-61102-B-53A)

(AD-759490; ECOM-5487) Avail: NTIS CSCL 04/1

A method has been devised, based on the Kubelka-Munk theory of diffuse reflectance, for obtaining an estimate of the optical absorption coefficient of a finely powdered material which has been collected on the surface of a membrane filter. The procedure does not require any knowledge of either the real refractive index or particle size distribution of the material. No mechanical or chemical processing is involved, and only one sample is required. Results of experimental tests on materials of known absorption coefficient are presented. Author (GRA)

N73-25745# Massachusetts Inst. of Tech., Cambridge. Spectroscopy Lab.

RESEARCH DIRECTED TOWARD THE DEVELOPMENT OF AN IMPROVED PROCESS FOR OPTICAL GRATING RULING Final Report, 31 Jan. 1970 - 29 Feb. 1972

George R. Harrison 30 Apr. 1972 17 p refs

(Contract F19628-70-C-0130; AF Proj. 7649)

(AD-758898; AFCRL-TR-73-0132) Avail: NTIS CSCL 20/6

The largest interferometrically controlled ruling engine yet constructed, of 18 x 24 inch capacity, is now in successful use, and has ruled more than 60 large diffraction gratings and echelles, in sizes up to 16 x 24 inches. Repiicas of echelles and gratings ruled, and some originals, are now in use at Sacramento Peak and Kitt Peak Observatories, and in various university laboratories. The machine has proved itself as reliable as much smaller engines, and the principal difficulties in ruling gratings in these previously unattainable sizes are found to relate to the obtaining of satisfactory blanks, suitable coatings, and to wear of the ruling diamond when total groove length exceeds about 80,000 meters per grating. Author (GRA)

N73-25746# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ACTION OF A MAGNETIC FIELD ON WATER

S. V. Shcherbakova 26 Mar. 1973 13 p refs Transl. into ENGLISH from Tr. Irkutskiy Politekhn. Inst. (Irkutsk), no. 46, 1969 p 23-38

(AD-758623; FTD-MT-24-1645-72) Avail: NTIS CSCL 07/1

The effect of a low intensity magnetic field on water as a flotation medium with the enrichment of coal and dressing of copper sulfide ore is studied. The dependence of the effect of a magnetic field on the intensity has a periodic nature. Hypothesis about the mechanism for the action of a magnetic field with flotation is expressed. The imposition of an external magnetic field disturbs the energy state of water, which leads to a change in intermolecular interaction, stability of hydrogen bonds, deterioration in the wettability of rigid surfaces, and a change in the technological indices of flotation enrichment.

Author (GRA)

N73-25747# Naval Postgraduate School, Monterey, Calif.

PARAMETRIC DIFFERENCE-FREQUENCY GENERATION OF SOUND IN AIR M.S. Thesis

William Pierce Shealy Dec. 1972 34 p refs

(AD-758682) Avail: NTIS CSCL 20/1

The study explores the feasibility of parametric difference-frequency generation in air through the interaction of two intense high-f equency sound waves. The sound pressure levels at various distances from the source are shown and the directivity of the difference-frequency is described. An experimental apparatus to generate the high-intensity primary signals is explained and some characteristics of the resonator are described. (Author Modified Abstract) GRA

N73-25748# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ADMITTANCE OF AN AXIAL SLOT BACKED BY A CYLINDRICAL CAVITY INSIDE AN INFINITE CYLINDER

Harold R. Raemer 3 Apr. 1973 59 p refs

(Contract F19628-73-C-0002; AF Proj. 1508A)

(AD-759568; TN-1973-17; ESD-TR-73-78) Avail: NTIS CSCL 20/3

A variational technique is applied to calculation of the admittance of a narrow longitudinal slot in a cylindrical cavity inside of an infinite cylinder. The technique is analogous to previously used by Galejs in calculating the admittance of a narrow rectangular slot backed by a rectangular cavity. The exciting current element is directed azimuthally on the slot. The slot is assumed sufficiently narrow to justify neglect of the longitudinal component of electric field. The azimuthally directed electric field is represented by a sum of trial functions, the tangential boundary condition for magnetic fields is applied on the slot, the admittance is expressed as a ratio of sums of unknown coefficients and a variation principle is applied to find optional values for these coefficients. (Author Modified Abstract) GRA

N73-25548* Eastman Kodak Co., Rochester, N.Y. Research Labs.

LIGHT SCATTERING IN PHOTOGRAPHIC MATERIALS FOR HOLOGRAPHY

Howard M. Smith *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 75-81 refs (For availability see N73-25540 16-16)

CSCL 20F

N73-25556* Tennessee Univ. Space Inst., Tullahoma.

SELECTIVITY AND NOISE EFFECTS IN APPLICATION OF OPTICAL CORRELATION

R. O. Webb and F. M. Shofner *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 153-161 refs Sponsored by AF Dyn. Lab. (For availability see N73-25540 16-16)

CSCL 20F

N73-25557* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ONBOARD OPTICAL DATA PROCESSING FOR SPACECRAFT

Akram S. Husain-Abidi *In its* Holography and Opt. Filtering

1973 p 163-171 (For availability see N73-25540 16-16)
CSCL 20F

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-25749 National Lending Library for Science and Technology, Boston Spa (England).
A HUNDRED YEARS OF RESEARCH INTO CONDENSATION NUCLEI
E. Meszaros [1973] 12 p refs Transl. into ENGLISH from Magyar Met. Tars. Foly., Idojaras (Budapest), v. 74, 1970 p 539-546
(NLL-M-22806-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Research into the phenomenon of condensation nuclei is described in terms of physical and chemical atmospheric processes. Emphasis is placed on the use of cloud and thermal diffusion chamber studies to determine the reaction characteristics of water vapor in both pure and impure air samples. In addition, various particles are analyzed according to their function as nucleic embryos of cloud droplets. J.M.M.

N73-25750 Arkansas Univ., Fayetteville.
THE PHYSICAL NATURE OF ELECTRON EMISSION FROM TIN OXIDE COLD CATHODE SOURCES Ph.D. Thesis
James Frederic Sprouse 1972 170 p
Avail: Univ. Microfilms Order No. 72-29648

The physical nature of electron emission from properly conditioned tin oxide films deposited along the inner diameter of capillary tubing was studied. The electron source is electrostatically analogous to a sandwich type configuration of conductor-insulator-conductor; therefore, application of a potential difference between the two edges of the tin oxide film appearing at each of the bore of the Vycor capillary tubing allows electrons to escape their potential well entrapment through the presence of electrostatic fields. Theories for pure field emission from metals and semiconductors equally well define the electron emission current experimental data. Dissert. Abstr.

N73-25751 Massachusetts Univ., Amherst.
SINGLET-TRIPLET MIXING IN HELIUM Ph.D. Thesis
Daniel Krause, Jr. 1972 144 p
Avail: Univ. Microfilms Order No. 72-33003

Experiments are described which have been used to explore the breakdown of the LS coupling scheme in the excited states of helium. It is shown that the spin-orbit interaction for the two electrons in helium mixes the spin states and that there is a small singlet component in the triplet state wave function. The square of the small singlet-triplet mixing parameter is equal to the ratio of the proton excitation cross sections to corresponding triplet and singlet states. Evidence for the breakdown of LS coupling is provided by measurements of the effect of the excitation transfer on the population of the 3 3D state of helium. Dissert. Abstr.

N73-25752 New York Univ., N.Y.
STUDY OF BEAM-FOIL SPECTROSCOPY Ph.D. Thesis
William A. Losonsky 1972 206 p
Avail: Univ. Microfilms Order No. 72-31104

The extent to which beam foil excitation produces unique spectral features is studied by sending a neon beam through a thin foil. The 137 BF lines recorded in the range 3664-6930 A were analyzed with respect to their wavelengths and relative intensities and compared with a gas excitation spectrum and the spectrum produced in various conventional sources. The spectral distribution of neon produced in the foil excitation experiment is the same as that of the gas excitation spectrum and that observed in glow discharge and spark sources. Dissert. Abstr.

N73-25753 California Inst. of Tech., Pasadena.
PHOTODISINTEGRATION OF HELIUM-3 AT ENERGIES BETWEEN 200 AND 600 MEV Ph.D. Thesis
Kirk Thomas McDonald 1972 193 p
Avail: Univ. Microfilms Order No. 72-30818

Differential cross sections were measured for the two body photodisintegration of helium-3 photon + He(3) yields p + d, between incident photon energies of 200 and 600 MeV, and for center of mass frame angles between 30 deg and 150 deg. Both final state particles were detected in arrays of wire spark chambers and scintillation counters; the high momentum particle was analyzed in a magnet spectrometer. The results are interpreted in terms of amplitudes to produce the delta (1236) resonance in an intermediate state, as well as non-resonant amplitudes. This experiment, together with an experiment on the inverse reaction, p + d yields He(3) + photon, will provide a reciprocity test of time reversal invariance. Dissert. Abstr.

N73-25754# Chicago Univ., Ill. Enrico Fermi Inst.
NUCLEAR CHEMISTRY RESEARCH Technical Progress Report, 31 Dec. 1971 - 31 Dec. 1972
N. Sugarman and A. Turkevich 31 Dec. 1972 25 p refs
(Contract AT(11-1)-1167)
(COO-1167-22) Avail: NTIS

Papers published during the period are reported, along with brief summaries of work in progress. The latter include fission and spallation by high energy protons, production of Be-7, Na-22,Ae-27 and Tb-149 by intermediate energy protons, analysis of meteorite composition, and development of radiation detection equipment. NSA

N73-25755# Illinois Univ., Urbana.
PHONON SCATTERING BY CONDUCTION ELECTRONS IN CARBIDES OF TRANSITION METALS
W. S. Williams 1972 5 p refs Presented at Intern. Conf. on Phonon Scattering in Solids, Paris, 3 Jul. 1972
(Contract AT(11-1)-1198)
(COO-1198-937; Conf-720720-1) Avail: NTIS

In summary, this work has provided: the first thermal conductivity data on single crystals of transition metal carbides in any temperature range; the first thermal conductivity data on transition-metal carbides in any form in the liquid helium range; an explanation for the low thermal conductivity of the carbides in this temperature range in terms of phonon scattering by conduction electrons; an explanation for the low thermal conductivity of the carbides at high temperatures in terms of phonon scattering by carbon vacancies; the discovery of a phonon switch; a successful application of BRT theory; and the first evaluation of an energy gap parameter for the transition metal carbides. Author (NSA)

N73-25756# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COLLECTION OF ABSTRACTS
Yu. I. Koptev 28 Mar. 1973 37 p refs Transl. into ENGLISH of Akad. Nauk SSSR, Fiz.-Tekhn. Inst., Leningrad, report, 1968 p 1-29
(AD-759252; FTD-MT-24-1799-72) Avail: NTIS CSCL 20/8

The paper contains brief discussions concerning elementary particle theories, nuclear reactions, solid state physics, and plasma physics. GRA

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-25757 Minnesota Univ., Minneapolis.
MICROWAVE PROPAGATION IN MAGNETOPLASMA-FILLED WAVEGUIDES Ph.D. Thesis
Tong Lu 1972 139 p
Avail: Univ. Microfilms Order No. 72-27773

Two methods of analyzing the wave properties in magneto-plasma-filled waveguides are studied: (1) the variational method, and (2) the Schelkunoff method. For the case of AMP (axially magnetized plasma), it was found that by means of an auxiliary

restriction on the choice of the trial field, the variational method yields identical results to that obtained by the Schelkunoff method. Such an auxiliary condition is termed a conditional stationary criterion. Since there is no available variational method for the TMP (tranversely magnetized plasma) filled rectangular waveguide, the Schelkunoff method was utilized exclusively. An examination of the resulting eigenvalue problem reveals that: whenever there is coupling to the transverse E-field components to the axial component of the electrical displacement vector, D, there is, in general, no similarity between forward and backward propagating waves. Such a character has profound effects on the manner of the em wave propagation in TMP. Dissert. Abstr.

N73-25758 Rensselaer Polytechnic Inst., Troy, N.Y.
PROPERTIES OF LOW FREQUENCY INSTABILITY IN A HOLLOW CATHODE DISCHARGE MAGNETOPLASMA Ph.D. Thesis
George Xavier Kambic 1972 150 p
Avail: Univ. Microfilms Order No. 72-30214

A low frequency drift instability, driven by plasma density and potential gradients, was studied in a plasma with electron temperature of approximately 5 eV and charged particle densities of approximately 5 x 10 to the 13th power/cu cm. The instability was examined experimentally for dependence on magnetic field, neutral gas pressure and gas flow rate into the discharge. Particular emphasis was placed on the phase difference between the potential and density oscillations associated with the instability. The instability frequency and growth rate were found to depend on the existence of transverse gradients and axial effects. The axial wavelength in particular was found to be necessary for the presence of the instability. The instability frequency did not vary inversely with the magnetic field strength as was predicted for drift waves. Dissert. Abstr.

N73-25759 Maryland Univ., College Park.
THE ROLE OF TURBULENCE IN THE COUPLING OF A MAGNETIC PULSE TO A COLLISIONLESS PLASMA Ph.D. Thesis
William DeOzro Davis, IV 1972 117 p
Avail: Univ. Microfilms Order No. 72-29429

The coupling of a magnetic pulse to an initially magnetized collisionless plasma is experimentally studied using a high voltage theta pinch. It is found that when the initial magnetic field is parallel to the magnetic field of the pulse (parallel case), the acceleration of the plasma can be explained almost entirely by the vector product of the current density, J, and the magnetic field, B where the current density is limited by a turbulent resistivity. When the initial magnetic field is antiparallel to the magnetic field of the pulse (antiparallel case), a strong particle pressure gradient is found to exist near the field reversal point. The plasma acceleration in this case is produced by the combination of the particle pressure gradient and the vector product of the current density, J, and the magnetic field, B. The current density is again limited by turbulence. The plasma turbulence is investigated in both parallel and antiparallel cases by electric probes and the helium satellite line technique.
Dissert. Abstr.

N73-25760* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETO-PLASMA-DYNAMIC ARC THRUSTER Patent
James A. Burkhart, inventor (to NASA) Issued 29 May 1973 7 p Filed 30 Aug. 1971 Supersedes N72-20691 (10 - 11, p 1510)
(NASA-Case-LEW-11180-1; US-Patent-3,735,591; US-Patent-Appl-SN-175852; US-Patent-Class-60-202; US-Patent-Class-313-161; US-Patent-Class-313-231) Avail: US Patent Office CSCL 20I

The performance of a magnetoplasmadynamic arc thruster, in the 600 to 2,100 seconds specific impulse range, was improved by locating its cathode in the exhaust beam downstream of the anode and main propellant injection point.
Official Gazette of the U.S. Patent Office

N73-25761 Delaware Univ., Newark.
TRANSPORT PROPERTIES OF PARTIALLY IONIZED GASES Ph.D. Thesis
Edwin John Miller 1972 227 p
Avail: Univ. Microfilms Order No. 72-32007

Transport properties of partially ionized gases are calculated from the perturbed Lorentzian solution of the Boltzmann kinetic equation. The basic idea of this solution is that the velocity distribution function of the electrons is computed as a perturbation to the distribution function for a Lorentzian mixture. The transport properties of both partially ionized argon and helium plasmas at 1 atm. pressure are calculated by the perturbed Lorentzian method and compared with the equivalent Chapman-Enskog calculations. For both gases the perturbed Lorentzian method converges more rapidly than the Chapman-Enskog method at low degrees of ionization. This is especially true for an argon plasma since the occurrence of the Ramsauer minimum in electron-atom cross sections causes very slow convergence of the Chapman-Enskog solution. Dissert. Abstr.

N73-25762# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
SIMULATION OF BELT PINCH EXPERIMENTS INCLUDING THE CIRCUIT EQUATIONS
D. W. Ignat and F. Hofman Mar. 1973 19 p refs
(LRP-61/73) Avail: NTIS HC $3.00

An existing 1-D MHD code was modified to compute belt pinch experiments including the interaction between the plasma and the external circuit and self-consistent determination of the field in the toroidal core. Results of a computation simulating the Garching experiment are compared with those of a similar calculation which assumes a sine-wave time dependence for the current in the coil. Simulations of the belt pinch under construction were executed. Ion temperatures of approximately 200 eV with a 10 m Torr D sub 2 filling were computed. Author

N73-25763# Max-Planck-Institut fuer Plasmaphysik, Munich (West Germany).
A SIMPLE LOW-LOSS COUPLING METHOD FOR RF HEATING OF PLASMA IONS BY ELECTROSTATIC ION-CYCLOTRON WAVES
S. Puri and M. Tutter Dec. 1971 8 p refs Presented at APS Plasma Phys. Meeting, Madison, 15-18 Nov. 1971 Submitted for publication
(IPP-4/30) Avail: NTIS HC $3.00

Recognition is made of the fact that for ion-Bernstein modes, the time of energy propagation readily exceeds the energy equipartition time due to ion-ion collisions. And further, since a large part of the wave energy resides in the ion motion perpendicular to the magnetic field direction, plus the fact that the energy density in the wave is small compared to the thermal energy density in the plasma, the wave is absorbed through ion-ion collisions in a manner similar to that of gyro-relaxation magnetic pumping. Author

N73-25764# Centro di Studio per la Chimica dei Plasmi, Bari (Italy).
EQUILIBRIUM COMPOSITIONS AND THERMODYNAMIC PROPERTIES OF MIXED PLASMAS. 3: ARGON-HYDROGEN PLASMAS AT .01 TO 100 ATMOSPHERES BETWEEN 2,000 K AND 35,000 K
M. Capitelli, E. Ficocelli, and E. Molinari [1973] 195 p refs
Avail: NTIS HC $11.75

Thermodynamic data of mixtures of diatomic gases with rare gases up to 35,000 K are presented. In tabular form, the results of equilibrium calculations for the system argon-hydrogen between 2,000 K and 35,000 K at .01, .1, 1, 10, 100, and 1,000 atmospheres are represented. Numerical values were reported for every 1,000 K and for compositions between 0 and 100% H2 at intervals of 20%. Author

N73-25765*# Linguistic Systems, Inc., Cambridge, Mass.
ROTATION OF THE ION COMPONENT OF A HOT CATHODE PENNING DISCHARGE PLASMA
L. I. Romanyuk and V. M. Lobodyan Washington NASA Jun. 1973 16 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 17, no. 12, Dec. 1972 p 2004-2010
(Contract NASw-2482)
(NASA-TT-F-14931) Avail: NTIS HC $3.00 CSCL 20I

It was experimentally established that in a hot cathode Penning discharge, ion azimuthal fluxes take place. Data were obtained on the radial profiles of linear velocity of the ion azimuthal

motion. These data indicate the absence of radial uniformity in angular velocity of this motion. The calculation of the radial profiles of the ion azimuthal motion velocity was carried out, using an equation obtained in a previous investigation. The results of the experiment are in good agreement with the calculation. The rotation of an ion component of plasma is shown to be chiefly due to drift of ions in crossed radial electric and axial magnetic fields with the presence of ion collisions with neutral particles. Author

N73-25766# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A SPATIAL FOURIER ANALYSER
Atsushi Ogata and Keizo Adati Mar. 1973 17 p
(IPPJ-T-13) Avail: NTIS HC $3.00

A device was constructed which calculates the Fourier coefficients and power spectral densities of spatially periodic signals, picked up from a set of magnetic probes positioned toroidally in a torus, or from a perpendicularly placed plasma to the magnetic axis in a linear machine or torus. Time variations of each coefficient and power spectral density are displayed on oscilloscopes with large signal bandwidths of dc to 10 MHz. Author

N73-25767# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ON THE PHYSICAL PICTURE FOR THE ANOMALOUS PROPAGATION OF AN ORDINARY WAVE IN A MAGNETO-PLASMA
Akio Ishida and Kazuo Kitao Feb. 1973 22 p refs
(IPPJ-153) Avail: NTIS HC $3.25

The physical picture for the anomalous propagation of an ordinary wave at a frequency near but below, the electron cyclotron frequency is discussed. The picture is analyzed on the basis of the single electron equation of motion in the magnetostatic and the wave fields. It is shown that the anomalous propagation originates from the forces along and across the magnetostatic field. The perpendicular force deflects the electrons and gives the density perturbation which contributes to the anomalous propagation, as shown by Fried. It is found, however, that the parallel forces connected with the gyration of the unperturbed motion also contribute to the anomalous propagation and accompany no density perturbation. Author

N73-25768# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ELECTROSTATIC OSCILLATIONS AND FEEDBACK CONTROL OF A LOSSFREE PLASMA
Kazuo Kitao Feb. 1973 18 p refs
(IPPJ-152) Avail: NTIS HC $3.00

The general features of the electrostatic oscillations in a lossfree plasma are discussed from the dispersion relation and energy equation. It is shown that the electrostatic waves in a lossfree plasma always have zero energy density and negative kinetic energy density, the magnitude of which is equal to the electrostatic energy density. The feedback stabilization for reactive instabilities is reconsidered by a simple model, and a cold electron plasma-beam system is studied as a simple example. Author

N73-25769# Nagoya Univ. (Japan). Inst. of Plasma Physics.
AN APPROACH TO MHD EQUILIBRIUM OF VARIOUS PLASMA CROSS SECTIONS
Yasuo Suzuki May 1973 35 p refs
(IPPJ-159) Avail: NTIS HC $3.75

A simple diffused-boundary model is presented for magneto-hydrodynamic equilibrium in straight plasma and toroidal plasmas with various plasma cross sections. Many examples of simple analytical solutions are given and the relation between the geometrical factors and plasma parameters is obtained for each example. Author

N73-25770# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CONTROL OF PLASMA CURRENT DISTRIBUTION BY RELATIVISTIC ELECTRON COMPONENTS
K. Ikuta and A. Mohri Mar. 1973 23 p refs
(IPPJ-158) Avail: NTIS HC $3.25

A possible method of controlling plasma current distribution in the diffuse pinch configuration is proposed. The equilibrium configuration is self-consistently constructed from a combination effect between the plasma force free current and the relativistic beam one. The parameters are found, which give an absolute minimum-B configuration. Author

N73-25771# Nagoya Univ. (Japan). Inst. of Plasma Physics.
LAMINAR ELECTROSTATIC SHOCK WAVES GENERATED BY AN ION-BEAM
H. Ikezi, T. Kamimura, M. Kako, and K. E. Longren Mar. 1973 38 p refs Submitted for publication
(IPPJ-156) Avail: NTIS HC $4.00

Strong laminar electrostatic shock waves were experimentally observed when an ion beam is injected into a collisionless plasma. The structure of the shock is qualitatively different from one with a trailing wave train. A density depression follows behind the shock front, and no trailing wave train due to wave dispersion is found. A significant amount of ions reflected from and transmitted through the shock front form a precursor. The critical Mach number above which no shock is formed is found to be 1.5. Numerical simulations reported here reproduce the experimental observations very well. An analysis based on the water-bag model accounts for the observed value of the critical ion beam velocity which gives the critical Mach number. It also points out that the reflected ions play an essential role in the presistence of the shock. Author

N73-25772# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANOMALOUS PENETRATION OF AN ORDINARY WAVE INTO A MAGNETOPLASMA SLAB
Akio Ishida and Kazuo Kitao Feb. 1973 34 p refs
(IPPJ-154) Avail: NTIS HC $3.75

The penetration of an ordinary wave into an infinite magneto-plasma slab was calculated by adopting the image-metal technique in treating the electrons reflected at the plasma boundaries. After general expressions were derived, The wave frequency was assumed to be near the electron cyclotron frequency. It was found that the evanescent wave penetrates deeply into the slap as compared with a cold plasma. The size effect appears to be due to the increase of the wave reflection at the plasma-vacuum boundary. The adsorptive power due to collisions, evaluated for the limiting case of infinite thickness of the slab, is much larger than the value for a cold plasma. Author

N73-25773# Nagoya Univ. (Japan). Inst. of Plasma Physics.
LECTURE NOTE ON COULOMB COLLISIONS
K. Nishikawa Feb. 1973 45 p refs
(IPPJ-151) Avail: NTIS HC $4.25

The properties of Coulomb collisions are discussed in terms of slow and collisional particles and fast and collisionless particles. A simple collision model, which features the untrapping of trapped particles and collisional damping of plasma wave echoes, is used to demonstrate the cumulative effect of small-momentum processes. In addition, consideration is made of Landau's derivation of the collision term from Boltzmann's binary-collision integral. J.M.M.

N73-25774# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ACCESSIBILITY OF ION-ION HYBRID RESONANCE
H. Toyama and K. Matsuura Mar. 1973 23 p refs
(IPPJ-157) Avail: NTIS HC $3.25

The dispersion relation for the ion-ion hybrid resonance was investigated in the density region of 1,000,000/cu cm to 10 to the 17th power/cu cm with the parallel wave number as the parameter. The accessibility condition is presented. Author

N73-25775# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NONLINEAR ION ACOUSTIC WAVES WITH LANDAU DAMPING
James W. VanDam and Tosiya Taniuti Mar. 1973 34 p refs
(IPPJ-155) Avail: NTIS HC $3.75

The Korteweg-deVries equation for the ion acoustic wave, modified to include the effects of ion and electron linear Landau damping, is rigorously derived from the Vlasov-Poisson equations by a multi-scale asymptotic expansion method. Careful examination of the various orderings also shows that nonlinear resonance effects (trapping, reflection) can be significant. Author

N73-25776# Sandia Labs., Albuquerque, N.Mex.
ALTERNATING DIRECTION IMPLICIT MHD CODE FOR SIMULATING LASER PLASMAS

M. M. Widner and T. P. Wright Jan. 1973 24 p refs Sponsored by AEC
(SC-DR-72-0733) Avail: NTIS

A two-dimensional, cylindrical MHD code, CLASP (Cylindrical Laser Plasma), was developed to study laser plasmas with self-generated magnetic fields included. Alternating Direction Implicit (ADI) difference methods are used on a regular Eulerian mesh and work well for problems whose time scale is governed by diffusion processes. In addition, flux-corrected transport algorithms provide improved accuracy for the hydrodynamics. A series of test problem and laser problem solutions is presented. The primary motivation for this development is the study of self-generated magnetic fields whose source in laser plasmas originates from a generalized Ohm's law. Author (NSA)

N73-25777# California Univ., Livermore. Lawrence Livermore Lab.
PLASMA PRODUCTION AND CONFINEMENT IN THE SUPERCONDUCTING LEVITRON
C. W. Hartman 17 Nov. 1972 27 p Presented at Plasma Physics Meeting of the Am. Phys. Soc., Monterey, Calif., 13-16 Nov. 1972 Sponsored by AEC
(UCRL-74337; Conf-721132-1) Avail: NTIS

The production and confinement of hot electron plasmas and the use of such plasmas to heat a high-density plasma by thermalization with the energetic electrons are described. The main thrust of the experiments described here is to utilize the remarkable and unique plasma confinement and stabilization properties of the vacuum fields of a single floating ring device. In particular, interest has been directed towards developing heating techniques and studying confinement at high beta. One of the most important results is that values of beta of several percent have been observed for what appears to be isotropic hot electron plasma, which can exhibit collective instability effects. Further, under proper conditions the confinement time of this high beta plasma is several seconds and essentially classical. NSA

N73-25778# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
EXPERIMENTAL INVESTIGATION OF AN IONIZING WAVE IN A COAXIAL PLASMA GUN
Ingvar Axnaes Dec. 1972 56 p refs Sponsored by the Swed. Atomic Res. Council
(TRITA-EPP-72-31) Avail: NTIS HC $5.00

In order to explain the phenomenon of anomalous interaction between plasma and neutral gas, the ionizing wave in a coaxial plasma gun with an azimuthal magnetic bias field is studied experimentally. The discharge current, filling pressure and magnetic field are chosen so that the plasma is weakly ionized. A lower limit to the ionization frequency is obtained by measuring the relaxation time of a burning voltage transient, caused by a sudden increase of the discharge current. The conditions before and after the transient are studied by means of floating double probes. The experimental results are compared with theoretical predictions from electron heating mechanisms. It is found that the experimentally measured ionization frequency is larger by 1-2 powers of ten than that theoretically predicted for classical processes.
Author (ESRO)

N73-25779# Institut Franco-Allemand de Recherches, St. Louis (France).
METHODS USING TEA-CO2 LASERS FOR THE INVESTIGATION OF TRANSIENT PHENOMENA
M. Hugenschmidt and K. Vollrath 7 Aug. 1972 23 p refs In GERMAN; ENGLISH summary Original contains color illustrations
(Contract T/0260/22630/21015)
(ISL-19/72) Avail: NTIS HC $3.25

In order to investigate plasmas with electron densities in the range of 10 to the 15th power to 10 to the 18th power/cu cm. Schlieren techniques and interferometric methods were used with a TEA-CO2 laser. The thermooptical conversion was achieved by means of cholesteric liquid crystal layers. The possible uses of this technique were examined with a view to recording dynamic transient phenomena, attention being paid to response time, resolving power, and quantitative information obtained. Examples are given for records taken from the formation and expansion of electric spark discharges. The experimental results are in good agreement with the computed numerical data. Author (ESRO)

N73-25780# TRW Systems Group, Redondo Beach, Calif.
MAGNETIC FIELD ANNIHILATION OF IMPULSIVE CURRENT SHEETS Interim Scientific Progress Report
Lee Dailey, Harold A. Davis, and Ralph H. Lovberg 31 Mar. 1973 56 p refs
(Contract F44620-71-C-0031; AF Proj. 9752)
(AD-758880; TRW-18706-6002-TU-00; AFOSR-73-0564TR) Avail: NTIS CSCL 20/9

An impulsive plasma accelerator employing two, closely spaced, flat, spiral, coils has been used to study plasma acceleration by magnetic field annihilation. Measurements of plasma current density and electric and magnetic field were made with miniature probes. Spectral measurements were made with a monochromater. Electron temperature and density were measured by line intensities and Stark broadening. There is good agreement between measured and calculated conductivity. Radial velocity measured by Doppler shift showed values produced by field annihilation were 3 times greater than the axial velocities prior to current sheet collision. A few percent of the capacitor bank energy was converted to radial ion kinetic energy. (Author Modified Abstract) GRA

N73-25781# Purdue Univ., Lafayette, Ind.
A PROCEDURE FOR TURBULENT ARC CALCULATIONS Interim Report, 21 Nov. 1971 - 20 Nov. 1972
William W. Bower and Frank P. Incropera Mar. 1973 66 p refs
(Contract F33615-72-C-1271; AF Proj. 7063)
(AD-759572; ARL-73-0038) Avail: NTIS CSCL 20/9

A mathematical model has been formulated for turbulent flow in both water-cooled and transpiration-cooled electric arcs. The model provides for the determination of flow profiles (velocity, temperature, turbulent shear stress, etc.) as well as for the determination of overall arc characteristics (electric field intensity and wall heat transfer). A finite-difference solution to the model is developed. Author (GRA)

N73-25782# Riverside Research Inst., New York.
DRIFT, DEFORMATION, AND DIFFUSION OF A PLASMA IN A MAGNETIC FIELD
R. Monroe 1 Jul. 1972 33 p refs
(Contract F19628-71-C-0162; ARPA Order 1088)
(AD-759742; RRI-T-54/174-4-50) Avail: NTIS CSCL 20/9

The theoretical problem of a weakly ionized, constant temperature, three particle plasma in an externally generated magnetic field is reformulated by transforming the set of 14 macroscopic plasma equations (continuity and momentum equations for ions and electrons plus Maxwell's equations) in 14 unknowns (ion and electron number densities and velocities plus the effective electric and magnetic fields) into an equivalent set of four integral equations in four unknowns. In the course of this transformation, it is shown that plasma behavior can be interpreted in terms of three ambipolar processes: drift, deformation, and diffusion. (Author Modified Abstract) GRA

N73-25783# Purdue Univ., Lafayette, Ind.
TURBULENT FLOW PREDICTIONS FOR THE ARGON CASCADE ARC Final Report, 21 Nov. 1971 - 20 Nov. 1972
William W. Bower and Frank P. Incropera Wright-Patterson AFB, Ohio ARL Mar. 1973 59 p refs
(Contract F33615-72-C-1271; AF Proj. 7063)
(AD-759183; ARL-73-0039) Avail: NTIS CSCL 20/9

A numerical model for the turbulent flow of argon in an arc has been solved for both water-cooled and transpiration-cooled configurations. Although the agreement with data obtained for a 1 cm diameter water-cooled arc is good, there is poor agreement with measured results for the transpiration-cooled arc. For the transpiration-cooled arc, the data is better corroborated by a laminar flow model. Turbulent flow parametric calculations have been performed for a large (2.54 cm diameter) water-cooled arc. Author (GRA)

N73-25784# Air Force Weapons Lab., Kirtland AFB, N.Mex.
BOUNCE: USER'S MANUAL Technical Report, Jan. - Oct.

1972
Brendan B. Godfrey, Clifford E. Rhoades, Jr., and Keith A. Taggert Mar. 1973 130 p refs
(AF Proj. 8809)
(AD-758809; AFWL-TR-72-232) Avail: NTIS CSCL 20/9

The report is intended primarily as a user's manual for the optimized one-dimensional, nonrelativistic electrostatic particle code BOUNCE. This code is particularly well suited for the investigation of nonlinear, laser-induced instabilities in a one-dimensional homogeneous plasma, but is useful for other simulations as well. A brief discussion of numerical techniques is included. Complete FORTRAN and CDC 6600 compass assembly language listings together with sample output are attached. Author (GRA)

N73-25785# Avco-Everett Research Lab., Everett, Mass.
AIR BREAKDOWN STUDIES Technical Report, 4 Mar. 1971 - 17 Jun. 1972
Robert E. Schlier, Anthony N. Pirri, and Dennis J. Reilly Feb. 1973 99 p refs
(Contract F29601-70-C-0073; AF Proj. 1256)
(AD-759567; AFWL-TR-72-74) Avail: NTIS CSCL 20/9

An experimental investigation of air breakdown caused by long duration 10.6 micron laser radiation has shown that breakdown initiated by large (15 to 35-micron diameter) alumina particles can occur at fluxes as low as 3 x 10 to the power of 6 watt/square cm. The breakdown occurred at a variable time after the onset of radiation, with delays typically in the 10 to 30-microsecond range, although both shorter and longer times were observed. Similar results were obtained with 20 to 30-micron diameter calcium carbonate particles. Open shutter and time-resolved photography showed that the breakdown was characterized by the formation of a pre-breakdown luminous vapor or plasma region. The laser used for the investigation was an electron beam-sustainer discharge gas laser with an output up to about 80 joules in a pulse of 100 microseconds duration. The laser beam was close to diffraction limited. The experiments were carried out at beam diameters ranging from 0.013 to 0.22 cm (at the half intensity points). (Author Modified Abstract) GRA

N73-25786# TRW Systems Group, Redondo Beach, Calif.
HIGH ALTITUDE PLASMA EFFECTS. PARAMETRIC EXCITATION BY AN ELECTROMAGNETIC PUMP IN A LARGE LABORATORY PLASMA (QUIPS: QUIESCENT PLASMA STUDIES), FIRST RESULTS Interim Report, Jul. 1972 - 31 Jan. 1973
Donald Arnush, Burton D. Fried, Charles F. Kennel, Reiner L. Stanzel, and Alfred Y. Wong Feb. 1973 42 p refs
(Contract F30602-72-C-0304; ARPA Order 1423)
(AD-759543; TRW-21961-6005-RV-00; RADC-TR-73-128) Avail: NTIS CSCL 20/9

A series of experiments are being carried out in the TRW large volume plasma facility, the QUIPS (Quiescent Plasma Studies) device. The purpose of the experiments is to study those parametric instabilities which are excited when high power microwaves propagate into a plasma cutoff region. The plasma instabilities have been observed with probes; in later experiments, Thompson radar scattering diagnostics will also be used. A variety of nonlinear effects which are consistent with the standard linear theory of parametric instabilities were observed, as well as other phenomena which are still the subject of theoretical study. The experimental results are grouped into the following topics: Parametric excitation of high frequency sidebands near the pump frequency; Excitation of low frequency oscillations; Propagation of ion acoustic waves in the presence of an electromagnetic wave pump; and Mode coupling of electron plasma waves and ion acoustic waves by an electromagnetic wave pump. (Author Modified Abstract) GRA

N73-25787# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
LITERATURE SURVEY ON PLASMA INSTABILITIES COVERING 1971 PUBLICATIONS PART 1: ABSTRACTS 1-217
G. Auer, F. Cap, and P. Shukla 31 Dec. 1972 440 p refs
(Contract F44620-72-C-0016; AF Proj. 9752)
(AD-759276; UNICP-SR94; AFOSR-73-0489TR) Avail: NTIS CSCL 20/9

The report is the first part of the literature survey on plasma instabilities covering the year 1971. This volume contains 217 abstracts, 68 survey reports on single instabilities, another report and a list of instabilities. (Author Modified Abstract) GRA

N73-25788# Air Force Weapons Lab., Kirtland AFB, N.Mex.
GENERATION OF HIGH ENERGY PLASMAS BY ELECTROMAGNETIC IMPLOSION Technical Report, Jan. 1972 - Jan. 1973
Peter J. Turchi (NRL) and William L. Baker May 1973 46 p refs
(AF Proj. 8809)
(AD-759826; AFWL-TR-73-56) Avail: NTIS CSCL 20/9

Multimegajoule, high-temperature, high-Z plasmas are of interest as high-intensity radiation sources for use in a number of applications. The paper describes a possible method of generating such plasmas by means of the j X B driven implosion of thin metallic-foil cylinders. Basic analytical guidelines are developed and the results of numerical computations are displayed. Experimental problems associated with the creation of high-energy plasmas by this technique are discussed with some initial experimental results presented. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-25789 National Lending Library for Science and Technology, Boston Spa (England).
A NEW PHENOMENON IN MOLTEN METALS AND SEMICONDUCTORS
E. S. Filippov [1973] 16 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb., Chern. Met. (Moscow), v. 9, 1972 p 169-175 In ENGLISH and RUSSIAN
(NLL-M-21580-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The density and light radiation of the following substances were investigated: the metals Pb, Al, Sn, Ag, and Cu, the semiconductors Ge, Bi, Ga, and In, and Ni-Nb, Fe-P, Fe-S, Ag-Cu, Ag-O, Cu-H, and Ag-H alloys. The measurements were made with the materials heated at approximately 850 C above melting point. An effect of increase in volume was revealed, with a region of reduced heat capacity. The following signs of transition to statistical packing were found: (1) the increase in volume and absorption of heat were equal in absolute magnitude to the effects when the elements were melted; (2) gaseous and highly volatile impurities (H,O,S,N, etc.) were evolved; and (3) the temperature of transition to statistical packing coincides with the temperature at which the rate of vaporization of elements abruptly increases. Author

N73-25790 Minnesota Univ., Minneapolis.
MAGNETIC PROPERTIES OF COBALT-RARE EARTH THIN FILMS Ph.D. Thesis
Steven Arthur Bendson 1972 199 p
Avail: Univ. Microfilms Order No. 72-27831

The magnetic properties of thin films over the whole range of composition from pure Co to 70% Gd (atomic) and from pure Co to 35% Sm (atomic) were studied. These samples were deposited by triode sputtering in .001 torr of argon from pure targets of cobalt and either samarium or gadolinium. The film thicknesses varied from 1000 Angstroms to about 5000 Angstroms but contained about the same amount of cobalt in each sample. Several different types of substrates were used including alumina, quartz, polished mica, and amorphous mica. Substrate temperature during formation was about 600 C. Tabulations of magnetic properties for each compositional series include magnetic moment density, hysteresis loop squareness, coercivity, and rotational hysteresis loss integral. Dissert. Abstr.

N73-25791 Maryland Univ., College Park.
MULTISTABLE SEMICONDUCTORS DEVICES AND INTEGRATED CIRCUITS Ph.D. Thesis

George Abraham 1972 295 p
Avail: Univ. Microfilms Order No. 72-28897

Several independent physical phenomena in bipolar semiconductor pn junction devices and integrated structures lead to voltage and current controlled negative resistance without the use of external feedback. These include avalanche breakdown, quantum mechanical tunneling, and minority carrier storage. Following a review of the physical processes involved, the Ebers-Moll model is extended to include integrated avalanche negative resistance devices on a common substrate. Two basic types of negative resistance elements may be utilized as a basis for generating multistable energy levels. Dissert. Absrt.

N73-25792 Minnesota Univ., Minneapolis.
A STUDY OF OPTICAL ACTIVITY AND RAMAN SCATTERING IN THE SODIUM NITRITE CRYSTALS Ph.D. Thesis
Mao-jin Chern 1972 168 p
Avail: Univ. Microfilms Order No. 72-27734

Optical activity and Raman scattering in sodium nitrite crystal were studied. The temperature behaviors of these optical properties were related to ferroelectricity in the substance. Optical activity is reported for the first time in single domain $NaNO_2$ crystals. A rotatory power of 15.7 deg mm for 6328 A radiation propagating down either optical axis was measured. The sense of rotation of the plane of polarization was opposite for each axis. Reversal of the direction of the spontaneous polarization by an externally applied electric field reversed the sense of rotation for each axis. As a result of the relation between the sense of rotation can be controlled by an external electric field. Optical rotation was found to be linearly proportional to the spontaneous polarization at all temperatures below the Curie temperature. Dissert. Abstr.

N73-25793 Polytechnic Inst. of Brooklyn, N.Y.
ANOMALOUS ABSORPTION EFFECTS IN PERFECT SINGLE CRYSTALS OF GERMANIUM Ph.D. Thesis
Gerard A. Haber 1972 183 p
Avail: Univ. Microfilms Order No. 72-28237

Experimental measurements were made of three related topics concerned with the anomalous transmission of X-rays through perfect single crystals of germanium. Various n-beam dynamical effects in Laue (transmission) geometry were investigated photographically. A careful study was made of regions near the enhancements and eclipses that occur when the condition is met for simultaneous multiple Borrmann diffraction. The cases of (000,111,111), (000,022,022,040), (000,022,111), 000,022, 111,113), and others were examined. Computer programs were set up to make possible the comparison of the results predicted by the dynamical theory of X-ray diffraction with the experimental findings. Dissert. Abstr.

N73-25794 California Inst. of Tech., Pasadena.
EFFECTS OF MAGNETOSTRICTION AND SUPERLATTICE FORMATION IN FERROMAGNETIC THIN FILMS Ph.D. Thesis
Gordon Oliver Johnson 1972 82 p
Avail: Univ. Microfilms Order No. 72-30807

The contribution to the magnetic uniaxial perpendicular anisotropy which arises from substrate constraint through magnetostrictive effects was measured in Ni-Fe and Ni-Co thin films evaporated on substrates at room temperature. This was accomplished by measuring the perpendicular anisotropy before and after removal of the film from the substrate. Data are given for the fcc crystal structure regions of both alloy systems, but data for Ni-Co include compositions with less than 60% Ni which have a small percentage of the hcp phase mixed with the fcc phase. The constraint contribution to the perpendicular anisotropy correlates well with the value of the bulk magnetostriction constant. Measured values of isotropic stress for films thicker than 600 A were 1.6 x 10 to the 10th power dyn/sq cm. In films less than 600 A thick the isotropic stress decreased with decreasing thickness. After removal of the films from the substrates, the measured perpendicular anisotropy deviated from the expected geometrical shape anisotropy near pure Ni in both alloys. Dissert. Abstr.

N73-25795 Auburn Univ., Ala.
CURRENT FILAMENTATION AND SECOND BREAKDOWN IN THIN FILM SILICON-ON-SAPPHIRE SEMICONDUCTOR DEVICES Ph.D. Thesis
Duane Henry Pontius 1972 145 p
Avail: Univ. Microfilms Order No. 72-31364

The formation of current filaments in silicon devices and the relationship between filamentation and second breakdown was investigated experimentally and also in terms of a theoretical electrical-thermal model. Thin film, vertical-junction, silicon-on-sapphire diodes were examined by use of a stroboscopic method. Thermal distributions on electrically heated homogeneous thin silicon films were also examined. The temperature distribution is deduced from the variation of the optical density of silicon with temperature. Dissert. Abstr.

N73-25796 Connecticut Univ., Storrs.
HIGH TEMPERATURE THERMAL CONDUCTIVITY OF COMPLEX DIELECTRIC CRYSTALS Ph.D. Thesis
Micheline Claudine Roufosse 1972 77 p
Avail: Univ. Microfilms Order No. 72-32251

Approximate expressions are obtained for the relaxation rate due to anharmonic phonon interactions at high temperatures. Crystal structure is included by summing over all participating inverse lattice vectors, and earlier results for simple crystal structures are extended to the case of large unit cells. Departures from the usual h is approximately 1/T dependence result from the limited coherence of the anharmonic interaction due to the finite phonon mean free path in the case when the cell dimension exceeds the mean free path. Departures from the 1/T dependence are also explained in the high temperatures region by the fact that the loci of contributing interactions have a finite thickness. Consequently, in the summation over inverse lattice vectors, only those leading to loci whose dimensions are larger than their thickness need be considered. Dissert. Abstr.

N73-25797 Stanford Univ., Calif.
STUDIES OF THE ELECTRON MIRROR MICROSCOPY AND ITS APPLICATIONS TO THE SUPERCONDUCTIVITY AND THE MAGNETISM Ph.D. Thesis
Sou-Tien Wang 1972 234 p
Avail: Univ. Microfilms Order No. 72-30717

Electron mirror microscopes were constructed. The first one was built to study the magnetic states of superconductors. Landau flux tubes in the niobium specimen were directly observed. Cylindrical flux wave motion was also seen. The second mirror microscope was built to study the influence of energy spread on the image contrast. To build the second mirror microscope, it was necessary to design and construct a high voltage, high current monoenergetic electron gun. The energy spread of this gun can be varied. With observable brightness, the minimum energy spread of the electron beam is 70 mv. The preliminary experiments have shown that the use of the monoenergetic illuminating beam has significantly improved the image contrast of the electron mirror microscope and hence increased the resolving power. In addition to the deflection contrast, intensity modulation contrast is proposed and formulated. Dissert. Abstr.

N73-25798 Tufts Univ., Boston, Mass.
ULTRASONIC ATTENUATION IN SINGLE CRYSTALS OF BISMUTH GERMANIUM OXIDE ($Bi_{12}GeO_{20}$) AT LOW TEMPERATURES Ph.D. Thesis
Elias Akanbi Omotoso 1972 189 p
Avail: Univ. Microfilms Order No. 72-30282

The ultrasonic attenuation of longitudinal acoustic waves in single crystals of bismuth germanium oxide was measured over a temperature range from 4.2 K to 70 K, using the pulse-echo technique. The frequency range of the impressed phonons was from 10 to about 70 meps. Measurements were made for phonons along the /100/, /110/, and /111/ crystallographic axes of the specimens. Analysis of the experimental results indicates that the attenuation could be accounted for entirely by the relaxation interaction of mobile charge carriers with the longitudinal electric fields of piezoelectric origin, which accompany the stress waves in the crystal. Based on this analysis, the electromechanical coupling constants obtained from the attenuation data are in excellent agreement with previously reported values. The

results of the velocity measurements showed some anisotropic character, especially along the /110/ direction. Dissert. Abstr.

N73-25799# Technische Hogeschool, Delft (Netherlands).
NUCLEATION IN CONTINUOUS AGITATED CRYSTALLIZERS Ph.D. Thesis
E. P. K. Ottens May 1973 89 p refs
(WTHD-44) Avail: NTIS HC $6.50

An investigation was made of the relation between the nucleation rate and the supersaturation, crystal concentration, growth behavior of the crystal, and the hydrodynamical behavior of the suspension in a continuous, agitated cooling crystallizer. Two crystallizing systems with different growth behavior were studied: the potassium alum-water system and the magnesium sulphate-water system. In order to examine the influence of the hydrodynamical behavior two types of cooling crystallizers were used: a stirred vessel crystallizer and a froth bed crystallizer, in which the crystals are suspended by bubble agitation. Different nucleation mechanisms are discussed along with experimental results. Author

N73-25800*# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL AND DEVICES Quarterly Report, 1 Oct. - 31 Dec. 1972
W. Murrary Bullis, ed. Jun. 1973 56 p refs Sponsored jointly by Def. Nucl. Agency, Navy Strategic Systems Proj. Office, AFWL, AFCRL, AEC and NASA
(NASA-CR-133030; NBS-TN-773) Avail: NTIS MF $1.45; SOD HC $0.80 Domestic Postpaid or $0.55 GPO Bookstore CSCL 20L

Significant accomplishments reported included: (1) completion of an investigation of the effects of current, probe force, and surface condition on the measurement of resistivity of bulk silicon wafers by the four-probe method, (2) establishment of operating conditions appropriate for determining the sensitivity of transient thermal response measurements to voids in transistor die attachment, and (3) initiation of an interlaboratory comparison of transistor scattering parameter measurements. Supplementary data concerning staff, standards committee activities, technical services, and publications are included. Author

N73-25801*# Linguistic Systems, Inc., Cambridge, Mass.
TEMPERATURE DEPENDENCE OF ELASTIC CONSTANTS AND THE DEBYE TEMPERATURE OF NaCl AND KCl SINGLE CRYSTALS
A. V. Sharko and A. A. Botaki Washington NASA Jun. 1973 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), v. 13, no. 6, 1970 p 22-28
(Contract NASw-2482)
(NASA-TT-F-14932) Avail: NTIS HC $3.00 CSCL 20L

The ultrasonic pulse method was used to measure the temperature changes, elastic moduli, the constants C sub (ik) and S sub (ik), the anisotropy factor, the uniform compression coefficient, and Poisson's ratio. The measurements were made in the temperature range of 300 to 1200 K for NaCl and 80 to 300 K for KCl. Based on the values of the elastic constants, extrapolated to 0 K, the Debye temperature of the compounds was found. Author

N73-25802# Florida State Univ., Tallahassee.
THE NATURE OF THE CRYSTALLINE STATE IN POLYMERS Final Report
Leo Mandelkern 30 Aug. 1972 16 p refs
(Contract DAHC04-69-C-0040; Grant
DA-ARO(D)-31-124-G788)
(AD-750157; Rept-73-01208) Avail: NTIS HC $3.00 CSCL 07/4

The polymer research, primarily concerned with the relationship between the crystallization kinetics and the resultant morphology and properties of the system that is formed is reported. There were two major areas of concern. One of these involves the properties of systems crystallized either in the bulk or from dilute solution. The other involves studies of different aspects of the mechanisms and kinetics of the crystallization process. Linear polyethylene was the principal polymer studied and all the work on properties was carried out with molecular weight functions. Author

N73-25803# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
SOLID STATE PHYSICS: MAGNETIC PHENOMENA Progress Report, 1 Jan. - 31 Dec. 1972
R. Bowers and R. H. Silsbee 1972 16 p refs
(Contract AT(11-1)-3150)
(COO-3150-10) Avail: NTIS

The two principal areas of interest using the technique of microwave resonance are discussed. These are the dynamic properties of orientable defects at low (liquid helium) temperatures and the electron spin resonance of dilute metal alloy systems. Particular emphasis is placed on the properties of the paramagnetic o (-) ion incorporated as a substitutional impurity in CaF2. The presence of the orbital electronic degeneracy of the o (-) ion and the high symmetry of the F (-) site in CaF2 imply that the system is susceptable to the Jahn-Teller effect. Author

N73-25804# Army Foreign Science and Technology Center, Charlottesville, Va.
AN ISOTROPIC REDISTRIBUTION OF CURRENT CARRIERS NEAR A CHARGED SEMICONDUCTOR SURFACE
Z. S. Gribnikov 13 Mar. 1973 22 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 16, no. 5, 1971 p 773-782
(AD-758973; FSTC-HT-23-1635-72) Avail: NTIS CSCL 20/12

An isotropic redistribution of carriers (APN) occurs when the current passes through the model near the semiconductor surface with several types of current carriers with different anisotropic mobility. These can be electrons and holes in a bipolar semiconductor, electrons from various troughs in a multitrough semiconductor, or electrons with different energies in a single trough semiconductor, situated in the magnetic field. APN in unipolar semiconductors leads to dimensional effects in electroconductivity and galvanomagnetic phenomena and also influences their photoelectric properties. In all the cases mentioned above, an important parameter in the theory is the surface relaxation velocity of the corresponding imbalance. The authors show that in semiconductors such a description is only satisfactory in the case of an impoverished or slightly enriched surface. (Author Modified Abstract) GRA

N73-25805# Office of Naval Research, London (England).
DIRECTORY OF EUROPEAN LOW TEMPERATURE RESEARCH
E. A. Edelsack, R. Kropschot (NBS, Boulder, Colo.), N. A. Olien (NBS, Boulder, Colo.), and J. L. Olsen (Eidgenoessische Technische Hochschule, Zurich) 26 Feb. 1973 44 p
(AD-757651; ONRL-D-16-73) Avail: NTIS CSCL 05/2

The Directory contains the names of over 300 persons in some 125 laboratories in 18 European countries who are engaged in low temperature research. Mailing address, telephone number and a brief description of the individual's research interest are included. Author (GRA)

N73-25806# California Univ., Irvine. Dept. of Physics.
SOFT MODE THEORY OF SURFACE RECONSTRUCTION
S. E. Trullinger and S. L. Cunningham Apr. 1973 15 p refs
(Contract N00014-69-A-0200-9003; Grant
AF-AFOSR-1936-70; NR Proj. 015-731)
(AD-758723; TR-72-67) Avail: NTIS CSCL 20/12

The authors present a mechanism capable of explaining surface reconstruction which is based on the fact that the presence of the surface can change the value of the dynamic effective charge on the atoms near the surface. A lattice dynamical calculation is performed and it is found that the long-range interaction between these induced charges can lower the frequency of the surface phonon to the point where the surface region becomes unstable and reconstruction must occur. Author (GRA)

N73-25807# Hebrew Univ., Jerusalem (Israel). Graduate School of Applied Science and Technology.
GROWTH OF BARIUM FERRITE FOR MAGNETIC OPTICAL DEVICES Final Technical Report, Mar. 1972 - Feb. 1973
M. Schieber and J. Eidelberg 8 Jan. 1973 25 p refs
(Contract DAJA37-72-C-277; DA Proj. 2o0-61102-B-31E)

(AD-758926; ARDG(E)-E-1543) Avail: NTIS CSCL 20/2
Single crystals of BaFe12O19 have been grown using the flux method. The initial weight composition from which the crystals were grown consists of 64.3 BaCO3, 15.5 B2O3, 34.5 Fe2O3 and 1 V2O3. This composition has been varied to add PbO instead of BaO and to increase or decrease the amount of V2O3, in order to change the fluidity of the melt and improve the grown crystals. (Author Modified Abstract) GRA

N73-25808# Lockheed Missiles and Space Co., Palo Alto, Calif.
LUMINESCENT APPLICATIONS OF RARE EARTH MATERIALS Final Report
R. A. Buchanan, T. G. Maple, H. N. Bailey, and R. V. Alves Feb. 1973 137 p refs
(Contract DAHC15-71-C-0138)
(AD-758760; LMSC-D315254) Avail: NTIS CSCL 20/12

The rare earth oxysulfide (REOS) family of luminescent materials was chosen as a model system for intensive investigation because of its unusually high luminescent efficiency. The objectives of this investigation were to develop practical applications for the high efficiency REOS materials and to gain a fundamental understanding of REOS's in order to design more efficient luminescent materials. The general effort of the applied portion of this program has been spent on the development of these luminescent films for CRT use. The following topics are discussed: Introduction to luminescent films; Film preparation; Properties of rare earth oxysulfide films; Contrast estimate of particulate and film screens; Mathematical model for light trapping in thin films; Increasing film efficiency via surface alternations. GRA

N73-25809# Naval Ordnance Lab., White Oak, Md.
THE AC HALL MOBILITY AND ELECTRICAL CONDUCTIVITY IN AMORPHOUS THRESHOLD SWITCHING SEMICONDUCTORS
G. P. Carver and R. S. Allgaier 2 Mar. 1973 45 p refs
(ARPA Order 1573)
(AD-759004; NOLTR-73-6) Avail: NTIS CSCL 20/12

Hall mobility measurements were made on bulk samples of the amorphous threshold switching compositions As(34.5) Te(27.9) Ge(15.6) S(22.0) and As(35) Te(40) Ge(7) Si(18) at frequencies from 10 to 100 kHz and at several temperatures between 220 and 250 K. The measurements were performed using a special Corbino disc apparatus designed for high resistance samples. A very high Hall mobility, which is an oscillatory, temperature dependent function of frequency, was found in both compositions, although it is not identical in the two materials. The frequency dependence was verified using a modified van der Pauw technique, which also demonstrated that the high mobilities correspond to positive carriers. (Author Modified Abstract) GRA

N73-25810# Research Inst. of National Defence, Stockholm (Sweden).
SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES. 1: PROMISING DESIGNS FOR STABLE PARTLY RESISTIVE QUANTUM INTERFERENCE DEVICES AND AN EASILY CONSTRUCTED SUPERCONDUCTING QUANTUM INTERFERENCE DEVICE
Bruno Slettenmark 1972 10 p refs
(PB-214757/7; FOA-2-B2034-E1) Avail: NTIS HC $3.00 CSCL 20L

Stable C-shaped and symmetric dc and RF voltage-biased superconducting quantum interference devices (SQUIDs) have been designed and tested for different applications. An easily constructed RF SQUID with the critical current of the point contact adjustable from outside the cryostat is described. General experience in constructing and operating the various devices is reported. Author (GRA)

N73-25811# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A UNIQUE HIGH TEMPERATURE, HIGH-PRESSURE CRYSTAL GROWTH SYSTEM FOR SILICON CARBIDE Instrumentation Papers
J. R. Littler, R. C. Marshall, C. E. Ryan, J. J. Hawley, and I. Berman 24 Jan. 1973 18 p refs
(AF Proj. 5620)
(AD-759786; AFCRL-IP-181; AFCRL-TR-73-0074) Avail: NTIS CSCL 20/2

A high-pressure, high-temperature furnace system is described for crystal growth experiments using crucibles up to 13 cm in diameter and 26 cm high. The vertical temperature gradient is electronically controlled during growth such that the ends of the crucible can be maintained at temperatures above or below the crucible center. Temperatures up to 2800C can be maintained at pressures up to 50 atmospheres. A vacuum capability up to .000001 torr at 1800C has been incorporated into the system. Single crystals of alpha silicon carbide grown in this system at 2600C are described to illustrate its use. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-25812# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
DIFFERENTIAL THERMOANALYSIS AND DILATOMETRY OF STORED AMMONIUM NITRATE WITH AMINE COPPER COMPLEX ADDITION DIFFERENTIALTHERMOANALYTISCHE UND DILATOMETRISCHE UNTERSUCHUNG GELAGERTEN AMMONIUMNITRATS MIT ZUSATZ VON AMMINKUPFERKOMPLEXEN]
W. Engel 15 Dec. 1972 33 p refs In GERMAN
(ICT-4/72) Avail: NTIS HC $3.75

Ammonium nitrate samples, after storage of 4 to 5 years, were investigated using differential thermal analysis (DTA) and, partly, also dilatometry. The samples contained additions of di- and tetra ammine copper dinitrates. The substances containing diammine copper additive showed little or no tendency to agglomeration, notwithstanding a high water content in some cases. The DTA produced no change of modifications beneath 50 C, except for a few samples with high water content. Dilatometric investigation confirmed a volume jump between 50 and 60 C. The good properties due to addition of the diammine complex were retained during long storage. Ammonium nitrate with tetrammine copper dinitrate showed equally good properties, which can be traced back to the unexpectedly low water content. ESRO

N73-25813# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Trauen (West Germany). Inst. feur Chemische Raketenantriebe.
IGNITION OF HYPERGOLIC LIQUID FUELS UNDER WATER
Werner Hartung and Helmut Koch 1973 41 p In GERMAN; ENGLISH summary
(DLR-MITT-73-07) Avail: NTIS HC $4.25; DFVLR, Porz, West Ger. 9,50 DM

The influences of water depth, the injector configuration and salt concentration in water were of special interest in these investigations. The results of nearly 1,850 experiments are discussed. Author (ESRO)

N73-25814# Naval Research Lab., Washington, D.C.
FLAMMABILITY PROPERTIES OF HYDROCARBON FUELS. PART 4: THE SIGNIFICANCE OF FLASH POINT AS AN INDICATOR OF THE FLAMMABILITY HAZARD OF HYDROCARBON FUELS Interim Report
W. A. Affens, G. W. McLaren, and H. W. Carhart 6 Mar. 1973 14 p refs
(NRL Proj. C01-03; SR0240201)
(AD-758643; NRL-7549) Avail: NTIS CSCL 21/4

The significance of flash point as a measurement of flammability hazard of flammable liquids and multicomponent solutions and its experimental determination were evaluated. Experimentally determined flash points were found to be in good agreement with values which were calculated from theoretical principles. The results confirm that liquid hydrocarbon solutions follow the laws of Dalton, Raoult, and LeChatelier

governing the vapor pressure, composition, and flammability limits above a liquid of two or more components, and also confirm the concept of flash point as that temperature at which the vapor concentration above a liquid is equal to that at its lower flammability limit. Author (GRA)

N73-25815# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
CHEMICAL STRUCTURE AGING EFFECTS
Lionel H. Layton Apr. 1973 83 p
(Contract F04611-71-C-0049)
(AD-759564; AFRPL-TR-73-27) Avail: NTIS CSCL 21/9

Aging and surveillance programs have been performed with solid propellants since their inception. To obtain some feel for the long term aging behavior in a short time, accelerated aging performed at elevated temperature has been used. It has been found that no comparison can be made between accelerated aging results converted to long time equivalent ambient aging and the actual long term ambient aging data. A study of the chemical changes occurring in TP-H1011 propellant with age at four temperatures has been made. It has been shown that the reaction responsible for the propellant cure is essentially complete in one week. Studies with NMR and EPR spectroscopy indicate that reactions are occurring at the sites of unsaturation along the polymer chain with a high percentage of the reaction at the pendant vinyl group. The reaction rate has been determined by following the change in gel found in the binder. A correlation of the mechanical properties and chemical changes has been made. (Author Modified Abstract) GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-25816*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONTROLLED SEPARATION COMBUSTOR Patent Application
Albert J. Juhasz and Richard N. Niedzwiecki, inventors (to NASA) Filed 24 May 1973 22 p
(NASA-Case-LEW-11593-1; US-Patent-Appl-SN-363691) Avail: NTIS HC $3.25 CSCL 21E

A short annular combustor is described which utilizes diffuser bleed to control the airflow distribution in a gas turbine engine at various operating conditions. This technique improves the performance of a gas turbine engine at idle, takeoff, cruise, and altitude relight operating conditions by varying the combustor airflow distribution using non-mechanical means. NASA

N73-25817*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYTIC AND EXPERIMENTAL PERFORMANCE OF TWO ISENTROPIC MIXED COMPRESSION AXISYMMETRIC INLETS AT MACH NUMBERS 0.8 TO 2.65
Donald B. Smeltzer and Norman E. Sorensen Washington Jun. 1973 57 p refs
(NASA-TN-D-7320; A-4675) Avail: NTIS HC $3.00 CSCL 21E

A mixed compression axisymmetric inlet model with a capture diameter of 50 cm was tested at Mach numbers ranging from 0.8 to 2.65 at 0 deg angle of attack and a constant total pressure of approximately 1 atm. Analytical methods accounting for the effects of both viscous and inviscid flows and incorporating empirical bleed discharge coefficients were used in the procedure for designing the inlet contours and the bleed system. Experimental results are compared with analytic predictions and are also compared with results from earlier tests of an inlet with the same internal contours but with a bleed system developed by cut and try methods in the wind tunnel. With the bleed configuration predicted by the design procedure, maximum total pressure recovery at the engine face at the design Mach number of 2.65 was 93 percent, with a total pressure distortion less than 10 percent. Corresponding bleed mass flow was approximately 7.5 percent, which was about 1.3 percent less than predicted. At lower supersonic Mach numbers, pressure recovery and bleed were generally lower and distortion generally higher. Author

N73-25818*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
SINGLE STAGE EXPERIMENTAL EVALUATION OF TANDEM-AIRFOIL ROTOR AND STATOR BLADING FOR COMPRESSORS. PART 4: DATA AND PERFORMANCE FOR STAGE B
J. A. Brent and J. G. Cheatham 15 Jun. 1973 273 p refs
(Contract NAS3-11158)
(NASA-CR-121145; FR-5083-Pt-4) Avail: NTIS HC $15.75 CSCL 21E

Stage B, composed of tandem-airfoil rotor B and stator B, was tested with uniform inlet flow and with hub radial, tip radial and 90 degree one-per-revolution circumferential distortion of the inlet flow as part of an overall program to evaluate the effectiveness of tandem airfoils for increasing the design point loading capability and stable operating range of rotor and stator blading. The results of this series of tests provide overall performance and blade element data for evaluating: (1) the potential of tandem blading for extending the loading limit and stable operating range of a stage representative of a middle stage of an advanced high pressure compressor, (2) the effect of loading split between the two airfoils in tandem on the performance of tandem blading, and (3) the effects of inlet flow distortion on the stage performance. The rotor had an inlet hub/tip ratio of 0.8 and a design tip velocity of 757 ft/sec. With uniform inlet flow, rotor B achieved a maximum adiabatic efficiency of 88.4% at design equivalent rotor speed and a pressure ratio of 1.31. The stage maximum adiabatic efficiency at design equivalent rotor speed with uniform inlet flow was 82.5% at a pressure ratio of 1.28. Tip radial and circumferential distortion of the inlet flow caused substantial reductions in surge margin. Author

N73-25819# Cranfield Inst. of Technology (England).
THE DESIGN OF A SHAFT CROSS COUPLING SYSTEM FOR THE ENGINES OF AN STOL AIRCRAFT
J. Webb Oct. 1972 15 p refs
(Cranfield-Aero-14) Avail: NTIS HC $3.00

The design of a system for mechanically cross coupling the engines of a STOL transport aircraft was studied, with emphasis on the initial design problems of selecting the operating speed and assessing the weight of the system. It was found that a minimum weight system will exist where by the speed limitations brought about by the shaft support and other bearings will determine the admissable weight of the system as a whole. Author

N73-25820*# TRW Systems Group, Houston, Tex.
STEADY-STATE SIMULATION PROGRAM FOR ATTITUDE CONTROL PROPULSION SYSTEMS
P. J. Heinmiller Mar. 1973 233 p refs
(Contract NAS9-12330)
(NASA-CR-128916; TRW-20029-H175-RO-00) Avail: NTIS HC $13.75 CSCL 21H

The formulation and the engineering equations employed in the steady state attitude control propulsion system simulation program are presented. The objective of this program is to aid in the preliminary design and development of propulsion systems used for spacecraft attitude control. The program simulates the integrated operation of the many interdependent components typically comprising an attitude control propulsion system. Flexibility, generality, ease of operation, and speed consistent with adequate accuracy were overriding considerations during the development of this program. Simulation modules were developed representing the various types of fluid components typically encountered in an attitude control propulsion system. These modules are basically self-contained and may be arranged by the program user into desired configuration through the program input data. Author

N73-25821*# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

PARAMETERS CONTROLLING NITRIC OXIDE EMISSIONS FROM GAS TURBINE COMBUSTORS

John B. Heywood and Thomas Mikus Apr. 1973 15 p refs Presented at AGARD Propulsion and Energetics Panel 41st Meeting on Atmospheric Pollution by Aircraft Engines, London, 9-13 Apr. 1973

(Grant NGL-22-009-378)

(NASA-CR-132959) Avail: NTIS HC $3.00 CSCL 21E

Nitric oxide forms in the primary zone of gas turbine combustors where the burnt gas composition is close to stoichiometric and gas temperatures are highest. It has been found that combustor air inlet conditions, mean primary zone fuel-air ratio, residence time, and the uniformity of the primary zone are the most important variables affecting nitric oxide emissions. Relatively simple model of the flow in a gas turbine combustor, coupled with a rate equation for nitric oxide formation via the Zeldovich mechanism are shown to correlate the variation in measured NOx emissions. Data from a number of different combustor concepts are analyzed and shown to be in reasonable agreement with predictions. The NOx formulation model is used to assess the extent to which an advanced combustor concept, the NASA swirl can, has produced a lean well-mixed primary zone generally believed to be the best low NOx emissions burner type. Author

N73-25822*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CALCULATED PERFORMANCE MAP OF A 4 1/2-STAGE 15.0 CENTIMETER (5.9 INCH) MEAN DIAMETER TURBINE DESIGNED FOR A TURBOFAN SIMULATOR

Charles A. Wasserbauer Washington Jun. 1973 14 p ref (NASA-TM-X-2822; E-7403) Avail: NTIS HC $3.00 CSCL 21E

The overall performance of an existing high-ratio turbine is calculated analytically over a range of speed and pressure ratio in order to determine its capability for other applications. The analytical performance covers a speed range from 50 to 120 percent of design and a pressure-ratio range from 5.0 to 35.0. The turbine was designed for a 50.8 centimeter (20.0 in.) tip diameter turbofan simulator. Computed results are compared with the experimental turbine data obtained from testing three fan configurations with the turbofan simulator in air. The comparison indicates good agreement over the range of speeds and pressure ratios covered by the experimental data. Author

N73-25823*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL COLD-FLOW EVALUATION OF A RAM AIR COOLED PLUG NOZZLE CONCEPT FOR AFTERBURNING TURBOJET ENGINES

David M. Straight and Douglas E. Harrington Washington Jun. 1973 25 p refs

(NASA-TM-X-2811; E-7387) Avail: NTIS HC $3.00 CSCL 21E

A concept for plug nozzles cooled by inlet ram air is presented. Experimental data obtained with a small scale model, 21.59-cm (8.5-in.) diameter, in a static altitude facility demonstrated high thrust performance and excellent pumping characteristics. Tests were made at nozzle pressure ratios simulating supersonic cruise and takeoff conditions. Effect of plug size, outer shroud length, and varying amounts of secondary flow were investigated. Author

N73-25824*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TERMINAL SHOCK POSITION AND RESTART CONTROL OF A MACH 2.7, TWO-DIMENSIONAL, TWIN DUCT MIXED COMPRESSION INLET

Gary L. Cole, George H. Neiner, and Robert J. Baumbick Washington Jun. 1973 44 p refs

(NASA-TM-X-2818; E-7223) Avail: NTIS HC $3.00 CSCL 21E

Experimental results of terminal shock and restart control system tests of a two-dimensional, twin-duct mixed compression inlet are presented. High-response (110-Hz bandwidth) overboard bypass doors were used, both as the variable to control shock position and as the means of disturbing the inlet airflow. An inherent instability in inlet shock position resulted in noisy feedback signals and thus restricted the terminal shock position control performance that was achieved. Proportional-plus-integral type controllers using either throat exit static pressure or shock position sensor feedback gave adequate low-frequency control. The inlet restart control system kept the terminal shock control loop closed throughout the unstart-restart transient. The capability to restart the inlet was non limited by the inlet instability. Author

N73-25825*# Tech Development, Inc., Dayton, Ohio.

DESIGN OF A MINIATURE HYDROGEN FUELED GAS TURBINE ENGINE

Mackenzie Burnett, Robert C. LoPiccolo, Marvin R. Simonson, George K. Serovy, Theodore H. Okiishi, Max J. Miller, and Fernando Sisto 2 Feb. 1973 262 p refs

(Contract NAS1-9752)

(NASA-CR-112173) Avail: NTIS HC $15.25 CSCL 21E

The design, development, and delivery of a miniature hydrogen-fueled gas turbine engine are discussed. The engine was to be sized to approximate a scaled-down lift engine such as the teledyne CAE model 376. As a result, the engine design emerged as a 445N(100 lb.)-thrust engine flowing 0.86 kg (1.9 lbs.) air/sec. A 4-stage compressor was designed at a 4.0 to 1 pressure ratio for the above conditions. The compressor tip diameter was 9.14 cm (3.60 in.). To improve overall engine performance, another compressor with a 4.75 to 1 pressure ratio at the same tip diameter was designed. A matching turbine for each compressor was also designed. The turbine tip diameter was 10.16 cm (4.0 in.). A combustion chamber was designed, built, and tested for this engine. A preliminary design of the mechanical rotating parts also was completed and is discussed. Three exhaust nozzle designs are presented. Author

N73-25826*# Analytical Mechanics Associates, Inc., Seabrook, Md.

SELECTED SOLAR ELECTRIC PROPULSION AND BALLISTIC MISSIONS STUDIES Final Report

F. I. Mann and J. L. Horsewood Jan. 1973 92 p refs

(Contract NAS5-21691)

(NASA-CR-132753; Rept-73-3) Avail: NTIS HC $6.75 CSCL 21C

Selected missions using solar electric propulsion and conventional propulsion systems were studied. The accomplishment of the tasks required extensive modification of the trajectory optimization computer program HILTOP. In addition to adding new program features, HILTOP was completely restructured to reduce execution time. The specific mission studies reported on are the direct and Venus swingby missions to the comet Encke and solar electric propulsion missions to Encke and to a distance of 0.25 AU from the sun. Author

N73-25827*# TRW Systems Group, Redondo Beach, Calif.

MONOPROPELLANT HYDRAZINE RESISTOJET: FLIGHT APPLICATION DESIGN Task Summary Report

Charles K. Kurch Mar. 1973 22 p refs

(Contract NAS5-11477)

(NASA-CR-132763; TRW-20266-6026-RO-00) Avail: NTIS HC $3.25 CSCL 21H

The design, development, and testing of an engineering model nominal 20-millipound thrust monopropellant hydrazine resistojet program is directed toward the advanced development of an electrothermal hydrazine thruster (EHT). The EHT decomposes hydrazine thermally and expands the decomposition products through a nozzle to provide the impulse necessary to fulfill spacecraft propulsive requirements. The thruster is capable of operation at pulse widths from 0.050 second to steady state and delivers specific impulse values up to about 230 seconds depending on the duty cycle. The program is comprised of six tasks including analyses, the generation of specifications and other documentation, design, fabrication and test, data correlation, and recommendations for the design of flight units. Author

N73-25828*# TRW Systems Group, Redondo Beach, Calif.

MONOPROPELLANT HYDRAZINE RESISTOJET: DATA CORRELATION

Charles K. Murch Mar. 1973 25 p refs

(Contract NAS5-11477)

(NASA-CR-130762; TRW-20266-6025-RO-00) Avail: NTIS HC $3.25 CSCL 21E

The design, development, and testing of an engineering model nominal 20-millipound thrust monopropellant hydrazine resistojet program is divided into six basic tasks. Included in these tasks are analyses, design, test, and data correlation of the electrothermal hydrazine thruster (EHT). A brief summary is provided of the analyses conducted for the EHT and the design of the engineering model thruster. Some of the results of the engineering model tests are then compared with the analytical performance models generated early in the program. Author

N73-25829*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-SPEED WIND TUNNEL INVESTIGATION OF THE AERODYNAMIC AND ACOUSTIC PERFORMANCE OF A TRANSLATING-CENTERBODY CHOKED-FLOW INLET
Brent A. Miller and John M. Abbott Washington Jun. 1973 32 p refs
(NASA-TM-X-2773; E-7372) Avail: NTIS HC $3.00 CSCL 21E

Low-speed wind-tunnel tests were conducted to determine the effects of free-stream velocity and incidence angle on the aerodynamic and acoustic performance of a translating centerbody choked-flow inlet. The inlet was sized to fit a 13.97 cm diameter fan with a design weight flow of 2.49 kg/sec. Performance was determined at free-stream velocities to 45 meters per second and incidence angles of 0 deg to 50 deg. The inlet was operated in both the choked and unchoked modes over a range of weight flows. Measurements were made of inlet total pressure recovery, flow distortion, surface static pressure distribution, and fan noise suppression. In the choked mode, increasing incidence angle tended to reduce the amount of inlet noise suppression for a given amount of inlet suction. This tendency was overcome by applying sufficient inlet suction to increase the flow Mach number. At 45 meters per second free-stream velocity, at least 22 decibels of suppression were measured at 35 deg incidence angle with a total pressure recovery of 0.985. Author

N73-25830*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF FINENESS AND CLOSURE RATIOS ON BOATTAIL DRAG OF CIRCULAR-ARC-AFTERBODY MODELS WITH JET EXHAUST AT MACH NUMBERS UP TO 1.3
David E. Reubush Washington May 1973 121 p refs
(NASA-TN-D-7163; L-8678) Avail: NTIS HC $3.00 CSCL 21H

The effects of variations in fineness ratio and closure ratio on the boattail drag of circular-arc afterbody models were investigated at static conditions and at Mach numbers from 0.40 to 1.30. Jet total-pressure ratio was varied from jet off to about 6, depending on Mach number. Reynolds number based on model maximum diameter varied from about 1.2 million to 2.18 million. Angle of attack was varied from -4 deg to 8 deg. The results indicate that, at subsonic speeds before the drag rise and at a scheduled pressure ratio, the total drag (pressure plus calculated skin friction) is approximately equal for configurations with the same closure ratio. Also, for configurations with the same closure ratio, increasing fineness ratio results in an increased drag-rise Mach number; and for configurations with the same fineness ratio, increasing closure ratio results in an increased drag-rise Mach number. Author

N73-25831*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE FROM TURBOMACHINERY
Charles E. Feiler and E. William Conrad 1973 13 p refs Proposed for Presentation at the 5th Aircraft Design, Flight Test and Operations Meeting, St. Louis, 6-8 Aug. 1973; sponsored by AIAA
(NASA-TM-X-68253; E-7529) Avail: NTIS HC $3.00 CSCL 13I

A review is made of turbomachinery noise from turbofan engines as typified by fan noise. The mechanisms and theories of fan noise are reviewed and concepts for its reduction, including acoustic suppression are discussed. Correlations of the overall noise data from several full-scale fans tested at NASA-Lewis Research Center are presented as indicative of the current state-of-the-art. Estimates are presented to show economics versus reduced noise for two quieted experimental engines, one with subsonic and one with supersonic fan tip speed. Finally, some concepts that may have the potential to reduce fan noise are indicated. Author

N73-25832*# Aerojet Nuclear Systems Co., Azusa, Calif.
ROCKET NOZZLE COOLANT CHANNEL THERMAL ANALYSIS PROGRAM (E25107)
W. R. Thompson 14 Apr. 1972 245 p
(NASA-CR-132185; N8110R-72-036) Avail: NTIS HC $14.25 CSCL 21H

A complete description of the liquid cooled rocket nozzle analysis program (E25107) is presented, including a users manual, program listing, and a sample problem. The program is recommended for use in designing liquid cooled rocket nozzles. In addition, it is adaptable to any system in which a liquid-cooled tubular structure is used to contain and direct the flow of a hot gas. Author

N73-25833# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
VELOCITY AND HEAT TRANSFER ANALYSIS IN CHANNELS WITH A POROUS WALL Technical Report, Apr. - Jun. 1971
Lucien L. Debruge Sep. 1972 98 p refs
(AF Proj. 3066)
(AD-758782; AFAPL-TR-72-31) Avail: NTIS CSCL 21/5

A method of cooling turbine blades internally by continuous injection through an interior baffle is analyzed. The analytical model consists of a two-dimensional channel formed by a solid wall (blade surface) and a porous plate (injection source). Based on incompressible and laminar flow assumptions the velocity and the temperature fields are determined. The Nusselt number for a power-law surface temperature variation is obtained and expressed in terms of the Prandtl and Reynolds numbers. The related problem of cooling the turbine disc is also solved. Author (GRA)

N73-25834# Ultrasystems, Inc., Irvine, Calif.
INSTABILITY AND NOISE GENERATION IN AIR BREATHING PROPULSION SYSTEMS Interim Progress Report, 1 Jun. 1971 - 31 May 1972
J. J. Tyson Jan. 1973 48 p refs
(Contract F44620-71-C-0104; AF Proj. 9711)
(AD-758890; AFOSR-73-0565TR) Avail: NTIS CSCL 21/5

The report presents the progress of research accomplished on instability and noise generation in airbreathing propulsion systems during the period 1 Jun 1971 to 31 May 1972. During this period the focus has been on the theoretical delineation of various possible afterburner instability mechanisms. A literature review was made of other investigations of mechanisms whereby energy is pumped from the combustion process into a standing or traveling wave system within the combustor cavity. A theoretical analysis was initiated based on a periodic vortex shedding model. It is hypothesized in this model that vorticity is shed in an oscillatory manner from the flame holder at a frequency consistent with the cavity resonance. (Author Modified Abstract) GRA

N73-25835# Advanced Technology Labs., Inc., Jericho, N.Y.
TIME-DEPENDENT SUBSONIC DIFFUSER ANALYSIS Technical Report, 1 Oct. 1971 - 31 Jul. 1972
John Erdos and John Ranlet Dec. 1972 75 p refs
(Contract F33615-72-C-1089; AF Proj. 1476)
(AD-758803; AFFDL-TR-72-148) Avail: NTIS CSCL 21/5

A mathematical model of the time-dependent flow in the subsonic diffuser section of an external compression, supersonic inlet is described. The flow is divided, in standard fashion, into inviscid and boundary layer components. The inviscid flow is assumed to be two dimensional (i.e., axisymmetric) as well as time-dependent, and the region considered extends from the inlet terminal shock to the engine face. A finite-difference technique for solution of the inviscid flow is developed utilizing a moving, polar coordinate system attached to the shock for the exterior flow field and a fixed, rectilinear system for the interior flow field. The boundary conditions consist of the inlet flow conditions upstream of the terminal shock and the pressure distribution at the engine face; either a steady, transient or periodic solution

can be sought depending on the imposed boundary conditions. Both laminar and turbulent boundary layers have been considered. (Author Modified Abstract) GRA

N73-25836# Army Foreign Science and Technology Center, Charlottesville, Va.
UNSTEADY THERMAL CONDUCTIVITY OF CYLINDRICAL PARTITIONS WITH A VARIABLE COEFFICIENT OF HEAT EXCHANGE
Yu. V. Vidin 15 Jan. 1973 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), no. 2, 1970 p 52-57
(AD-759815; FSTC-HT-23-1047-72) Avail: NTIS CSCL 21/8

To detect the temperature field in a number of devices, for example, in the wall of a reactive motor or the body of a rocket, one must solve the equations of thermal conductivity with non-symmetrical boundary conditions. The analytical calculations present in literature of the methods are true only for cases of constant coefficients of heat exchange. However, under actual conditions, the warm-up process, as a rule, is accompanied by essential changes in the coefficients of heat emission according to time. Author (GRA)

N73-25837# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MANUFACTURE OF THE BASIC PARTS OF AIRCRAFT ENGINES
M. I. Evstigneev and I. A. Morozov 31 Jan. 1973 663 p refs Transl. into ENGLISH of the mono. "Izogotovlenie Osnovnykh Detalei Aviatvigatelei" Moscow, Izd-vo Mashinostroyeniye, 1972 p 1-478
(FTD Proj. 60108; FTD Proj. T72-01-40)
(AD-759577; FTD-MT-24-1460-72) Avail: NTIS CSCL 21/5

In the book, which is an educational aid for students of aviation higher educational institutes and schools, are discussed the technological processes of manufacture of the critical parts of engines of flight vehicles. Their structural features, technical specifications for manufacture and materials, the structure of technological processes, the methods of carrying out basic operations, methods and means of control are examined. Information is given on the technology of manufacture of parts from plastics and refractory materials. Author (GRA)

N73-25838# Lockheed Propulsion Co., Redlands, Calif.
USER'S MANUAL FOR NOZZLELESS ROCKET MOTOR INTERNAL BALLISTICS COMPUTER PROGRAM Technical Report, 1 Jun. 1972 - 31 Jan. 1973
David P. Harry, III, Chan F. Price, Kenneth R. Small, and Donald E. Taylor Mar. 1973 82 p
(Contract F04611-72-C-0076)
(AD-759559; AFRPL-TR-73-20) Avail: NTIS CSCL 21/8

The objective of this work was to develop a CDC 6400 FORTRAN computer program capable of accurately predicting the internal ballistics of motors designed for operation without nozzles. To accomplish this, previously obtained data were examined in detail. In addition, 12 motors were fabricated and test fired to augment the range of available test data. The computer program developed had to consider the effects of erosive burning, grain deflection, and incomplete metal combustion upon nozzleless motor performance. Input requires knowledge of motor geometry, propellant thermochemistry, base burn rate, and specification of erosive burning and grain deflection parameters. Comparisons of predicted and actual results show that where an adequate data base exists, with regard to erosive burning and grain deflection effects, accurate predictions will be provided by the computer program. (Author Modified Abstract) GRA

N73-25839# Plasmadyne Corp., Santa Ana, Calif.
PLASMA ACCELERATION ANALYSIS FOR ADVANCED PROPULSION ENGINE DESIGN Final Report
Adriano C. Ducatti Mar. 1973 100 p refs
(Contract F44620-70-C-0002; AF Proj. 9752)
(AD-759272; FR-033; AFOSR-73-0837TR) Avail: NTIS CSCL 21/3

The report describes the work performed for the evaluation of losses in plasma jet engines and the examination of possible ways of reducing these losses. Improved space simulation was accomplished by using consumable electrodes while the study of loss mechanism focussed on the investigation of a pure magnetic nozzle. Stable operation of the jet has been found difficult to achieve in a hard vacuum without some type of an enclosure for the arc changer. The evaporation rate of the cathode has been found to be independent of the electrode diameter while the anode consumption depends on the electrode size. Resistive losses of the consumable electrodes have important influence on thruster performance. Some progress has been made in concentrating the cathode spot. (Author Modified Abstract) GRA

N73-25840# Technion, Inc., Monrovia, Calif.
ADVANCED ELECTRIC THRUSTER (A SPACE ELECTRIC RAMJET) Final Technical Report
Gordon L. Cann Edwards AFB, Calif. AFRPL Apr. 1973 119 p refs
(Contract F04611-73-C-0020; AF Proj. 10-003)
(AD-759290; AFRPL-TR-73-12) Avail: NTIS CSCL 21/3

Laboratory experiments have established that axisymmetric plasma accelerators using a solenoidal magnetic field can produce thrust by recycling the ambient material of the vacuum tank in which they were operated, indicating that an electromagnetic accelerator on a satellite at low altitude should be able to ionize and accelerate air streaming by it and produce thrust for drag make up. This principle is the basis of the space electric ramjet. Use of solar cell arrays to supply power gives the system a theoretical unlimited total impulse, otherwise limited by engine cathode and anode lifetimes. Minimum system performance requirements for drag make up in the 100-300 miles altitude range are computed. Basic design parameters for system components (anode, cathode, magnet coil, insulators) and power requirements are calculated. (Author Modified Abstract) GRA

N73-25841# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE VOLUMETRIC TEMPERATURE FIELDS OF AN INTERNALLY-COOLED ROTATING BLADE
L. A. Kozdoba and L. V. Knyazev 28 Mar. 1973 14 p refs Transl. into ENGLISH from the book "Teploobmen v Energ. Ustanovkakh" Kiev, 1967 p 26-35
(AD-759246; FTD-MT-24-1739-72) Avail: NTIS CSCL 21/5

In order to obtain reliable data on the thermal condition of a continuous rotating gas-turbine blade when cooled by purging through passages between the blade root and the blade tip it is necessary to use volumetric electric models. A volumetric composite model (electro-conductive paper-grid of ohmic resistances) makes it possible to reveal such heat flows in designs which cannot be obtained on a two-dimensional models. GRA

N73-25842# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL STUDY OF THE EFFECT OF SUBSONIC EXHAUST GAS DIFFUSERS ON THE TEST CELL WALL AND TF39 COLD FLOW MODEL ENGINE EXHAUST NOZZLE PLUG AND CORE ENGINE COWL SURFACE PRESSURES Final Report, Jul. 1971 - Jun. 1972
Delbert Taylor, Marvin Simmons, and Frank T. Lee AEDC Apr. 1973 91 p refs
(ARO Proj. RW5224)
(AD-759177; ARO-ETF-TR-72-130; AEDC-TR-73-13) Avail: NTIS CSCL 21/5

An experimental investigation was conducted to determine the effects of exhaust gas collectors/subsonic diffusers on engine and test cell surface pressures during tests of high-bypass-ratio front-fan engines in ground test facilities. A one-tenth scale model of a TF39 turbofan engine installed in a one-tenth scale model of Propulsion Development Test Cell (J-1) was employed. Engine cowl and plug surface pressure data were recorded during model engine operation with cold air at five simulated power settings without exhaust collector, with exhaust collector, with exhaust collector equipped with a conventional subsonic diffuser, and with exhaust collector equipped with a segmented subsonic diffuser which separately diffused the fan and core engine exhaust jets. (Author Modified Abstract) GRA

N73-25021 Ministry of Aviation, London (England).
THE TEST PERFORMANCE OF HIGHLY LOADED TURBINE STAGES DESIGNED FOR HIGH PRESSURE RATIO

I. H. Johnston and D. C. Dransfield *In* ARC Aerodyn. Res. Prcgr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 653-682 refs Previously issued as NGTE-R-235; ARC-21245 (For availability see N73-25020 16-01)
(ARC-R/M-3242; NGTE-R-235; ARC-21245)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-25843 Stanford Univ., Calif.
A STUDY OF SOLAR-WIND STORMS: FEATURES DEDUCED FROM RADIO-PROPAGATION MEASUREMENTS OF ELECTRON CONTENT Ph.D. Thesis
Jeremy Alan Landt 1972 118 p
Avail: Univ. Microfilms Order No. 72-30655

In recent years, knowledge of the solar wind has increased rapidly, but few observations have been reported concerning the geometries of large-scale solar-wind disturbances that are known as blast waves, driven waves, and colliding streams. These and other disturbances characterized by large increases in density (solar-wind storms) are investigated through comparisons of single-location measurements to the average of the electron density obtained by radio signal delay measurements along a radiopath between earth and interplanetary spacecraft. Previous studies indicate that blast and driven waves should have broad spherical structures, and this is confirmed for some events. Shapes of other solar-wind storms are derived, among which a new class of spatially limited storms is identified; these structures contain regions with densities greater than any observed in the broad storms. Mechanisms involved in the confinement and deceleration of these compact disturbances are examined, and it is determined that the ram pressure may be responsible for some of their properties. Dissert. Abstr.

N73-25844 Minnesota Univ., Minneapolis.
A SEARCH FOR GAMMA RAY EMISSION FROM THE REGION OF THE GALACTIC CENTER Ph.D. Thesis
Glen Hamilton Dahlbacka 6 Jul. 1973 135 p
Avail: Univ. Microfilms Order No. 72-32284

A balloon borne gamma ray telescope was flown on March 26, 1970 from Australia to investigate the primary gamma emission from the region of the galactic center. The gamma ray telescope consisted of a photographic nuclear emulsion in combination with a spark chamber hodoscope. The instrument has an angular resolution of + or - 0.75 deg and as designed, was capable of detecting a flux of about 0.000001 photons/sq cm sec against the ambient atmospheric background of cosmic ray induced gamma rays. Three observed areas had an enhanced number of gamma ray areas. Although no single area was statistically significant, the Poisson probability of all three areas being due to statistical fluctuations was about 0.001. No excess line emission was observed from the galactic plane. The atmospheric gamma ray background production was studied in detail and was found to obey a power law spectrum.
Dissert. Abstr.

N73-25845 Yale Univ., New Haven, Conn.
A MODEL FOR THE STEADY STATE INTERACTION OF THE SOLAR WIND WITH THE MOON Ph.D. Thesis
Peter James Catto 1972 131 p
Avail: Univ. Microfilms Order No. 73-1

Three different limits of steady state equations are derived from reduced Vlasov equations and associated equations of the reduced description for application to solar wind-moon interaction problems. A numerical solution to the less complicated limits are presented and discussed. A technique is also presented where the three limts can be approximately extended to cases in which the electron thermal terms are comparable or larger than a dominate term retained. Dissert. Abstr.

N73-25846*# National Aeronautics and Space Administration, Washington, D.C.
THE QUIET SUN
Edward G. Gibson 1973 344 p refs
(NASA-SP-303; LC-72-600092) Avail: NTIS MF $1.45; SOD HC $6.20 Domestic Postpaid or $5.75 GPO Bookstore CSCL 03B

An up-to-date textbook of solar physics is presented. The solar structure and processes, and the interior are described along with the photosphere, the chromosphere, and the corona. The strongest Fraunhofer lines, visible coronal lines, and coronal UV, XUV, and X-ray lines are listed. F.O.S.

N73-25847*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DAMPING OF HIGH FREQUENCY WAVES IN THE SOLAR WIND
M. L. Goldstein and L. A. Fisk Jun. 1973 17 p refs Submitted for publication
(NASA-TM-X-66254; X-661-73-139) Avail: NTIS HC $3.00 CSCL 03B

Cyclotron damping by suprathermal fluxes of protons and electrons in the interplanetary medium will greatly attenuate high frequency Alfven waves and whistler waves within distances < 1 AU of the sun. Electrons with energies between 50 eV to 2 KeV are heated as a result of damping interplanetary whistler waves with frequencies 2 < omega meson/2 pion < 30 Hz in the frame of the solar wind. This heating may account, in part, for the observed suprathermal tail of solar wind electrons. Protons with energies approximately < 50 KeV damp Alfven waves with frequencies .001 < omega meson/2 pion < .01 Hz. This damping mechanism may explain several features of a scatter free solar electron events and high intensity, anisotropic solar proton streams. Author

N73-25848*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW APPROACH TO COSMIC RAY DIFFUSION THEORY
Frank C. Jones, Thomas B. Kaiser (Md. Univ., College Park), and Thomas J. Birmingham Jun. 1973 12 p refs Submitted for publication
(Grant NGL-21-002-033)
(NASA-TM-X-66263; X-641-73-177) Avail: NTIS HC $3.00 CSCL 03B

An approach is presented for deriving a diffusion equation for charged particles in a static, random magnetic field. The approach differs from the usual, quasi-linear one, in that particle oribits in the average field are replaced by particle orbits in a partially averaged field. In this way the fluctuating component of the field significantly modifies the particle orbits in those cases where the orbits in the average field are unrealistic. The method permits the calculation of a finite value for the pitch angle diffusion coefficient for particles with a pitch angle of 90 rather than the divergent or ambiguous results obtained by quasi-linear theories. Results of the approach are compared with results of computer simulations using Monte Carlo techniques.
Author

N73-25849*# American Science and Engineering, Inc., Cambridge, Mass.
HIGH RESOLUTION STUDIES OF THE SOLAR X-RAY CORONA FROM AEROBEE ROCKETS Final Report, 15 Dec. 1971 - 30 Apr. 1973
J. M. Davis, R. Haggerty, A. S. Krieger, H. Manko, G. Sherman, J. W. S. Ting, and G. S. Vaiana 30 Apr. 1973 48 p
(Contract NASw-2347)
(NASA-CR-132984; ASE-3268) Avail: NTIS HC $4.50 CSCL 03B

The research in high resolution solar X-ray astronomy is reported. The payload for the Aerobee 150 launch vehicle, which included a 23 cm diameter mirror whose polished surface was a nickel-phosphorus alloy is discussed along with the high resolution measurements, by Flight 13.028 CS, of the temperature and density structure of the lower corona. Flight 13.029 CS is also discussed. F.O.S.

N73-25850# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
DOUBLE LAYERS AND TWO-STREAM INSTABILITY IN SOLAR FLARES
Per Carlqvist Feb. 1973 21 p refs
(TRITA-EPP-73-05) Avail: NTIS HC $3.25

The formation of electrostatic double layers in plasmas is considered in connection with a theory of solar flares. Laboratory experiments on current interruption and double layers are reviewed. An evacuation mechanism which may lead to the formation of double layers in the solar atmosphere is discussed. The evacuation mechanism is shown to be intimately related to the two-stream instability. The evacuation starts when the current density in the plasma exceeds the critical limit for the two-stream instability. Author (ESRO)

N73-25851# Naval Research Lab., Washington, D.C.
LABORATORY-PRODUCED RADIATION RELATED TO THE SOLAR FLARE EMISSION
R. C. Elton and T. N. Lee 1972 16 p refs Repr. from Space Sci. Rev., v. 13, 1972 p 747-760
(AD-758606) Avail: NTIS CSCL 03/2

A review is given of continuing efforts to generate laboratory spectra at photon energies above 1 keV from highly ionized atoms. Emphasis is placed on the most easily-interpreted highest ion stages such as the hydrogenic, helium-like and lithium-like species. The close similarities to solar flare observations of certain signatures, such as the line and continuum X-ray spectra and microwave emission as well as their sequence of occurrence, are pointed out and scaling factors are given. Author (GRA)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-25852 Osservatorio Astronomico, Roma (Italy).
SPECTROPHOTOMETRY OF COOL STARS IN THE NEAR INFRARED. 2: RESULTS FOR A REGION IN THE DIRECTION OF THE GALACTIC ANTICENTRE
K. Nandy and F. Smriglio 1971 18 p refs Repr. from Publ. of Roy. Obs. (Edinburgh), v. 7, no. 6, 1971 p 73-84
Copyright. Avail: Issuing Activity

Spectral types and infrared magnitudes of M and C stars brighter than V = 15.0 were obtained for a region of about 10 square degrees in the direction of the galactic anticenter. The spectral classification is based on the relative strengths of molecular bands visible in the infrared in low dispersion objective prism spectra. It is found that the number of M stars fainter than infrared magnitude 10.0 decreases sharply in this direction. It is argued that the observed decrease in the number of M stars indicates the presence of high interstellar obscuration and not a real deficiency of M stars. The total visual extinction A(v) at the distance of 2.5 kpc is estimated to be over 5.0 in this direction. From the study of the space distribution of M stars it is concluded that the Perseus arm may extend to approximately 2 kpc from the Sun in the anticenter direction. Author

N73-25853 Maryland Univ., College Park.
DESIGN TESTS OF THE FULLY STEERABLE WIDEBAND DECAMETRIC ARRAY AT THE CLARK LAKE RADIO OBSERVATORY Ph.D. Thesis
James Richard Fisher 1972 210 p
Avail: Univ. Microfilms Order No. 72-29606

This array will be a T of 720 conical spiral antennas (teepee-shaped antennas, the array is called the TPT), 3.0 km by 1.8 km capable of operating between 10 and 110 MHz. Both its operating frequency and beam position will be adjustable in less than one millisecond, and the TPT will provide a 49-element picture around the central beam position for extended-source observations. Included in this thesis is a description of this array and the associated electronics along with an outline of some of its astronomical applications. Dissert. Abstr.

N73-25854 Michigan Univ., Ann Arbor.
VARIATIONS IN THE 8 GHz FLUX DENSITY AND LINEAR POLARIZATION OF EXTRAGALACTIC RADIO SOURCES Ph.D. Thesis
Edward Tait Olsen 1972 132 p
Avail: Univ. Microfilms Order No. 72-29162

The linear polarization of radio sources which exhibit variations in flux density were monitored at 8 GHz since 1965 with 85-foot reflector equipped with a rotating linearly polarized feed horn. Significant variations were detected in the total flux density and linearly polarized emission of radio sources 4C39.25 and BL Lacertae, and continued variations were observed in 3C120, 3C273, 3C279, 3C345, and 3C454.3. The time scale for these variations has ranged from less than one week in the case of BL Lacertae to more than four years for 4C39.25. Comparison of the polarization observations with the small scale structure was observed by very long baseline interferometry revealing that variable polarization is closely correlated with the structure of the compact sources. Dissert. Abstr.

N73-25855 Purdue Univ., Lafayette, Ind.
FLUID DYNAMICS OF METEOR EXPLOSIONS IN A HETEROGENEOUS ATMOSPHERE Ph.D. Thesis
Allen Stewart Novick 1972 285 p
Avail: Univ. Microfilms Order No. 72-30948

The disintegration of meteors is studied in accordance with the hypothesis presented concerning the mechanical failure of meteors due to aerodynamic forces. The Tunguska Meteorite catastrophe of 1908 is examined with regard to the following topics: (1) what type of cosmic body entered the atmosphere and caused the devastation; (2) what was the altitude and energy of the atmospheric explosion; (3) where may particles of the bolide be found. General conclusions about meteors exploding in the atmosphere are summarized as follows. Micrometeorites will not experience aerodynamic pressure greater than the compressive strength of the meteoric material and therefore will not explode. Dissert. Abstr.

N73-25856 Yale Univ., New Haven, Conn.
EVOLUTION ON THE ASYMPTOTIC BRANCH OF A GLOBULAR CLUSTER STAR OF LOW MASS Ph.D. Thesis
John G. Mengel 1972 53 p
Avail: Univ. Microfilms Order No. 72-31452

A theoretical study of the asymptotic-branch evolution of a globular cluster star of 0.60 solar mass with the composition X = 0.732, Z = 0.001 in the envelope has been made. The major objective has been to determine whether the readjustment of the envelope following the flashes in the thermally unstable helium burning shell can cause the track in the H-R diagram to depart from the asymptotic branch. The results suggest that of the approximately 12 relaxation cycles of this star only the last 1 or 2 cycles on the asymptotic branch will result in loops extending into the instability strip. Addition computations for the composition X = 0.600, Z = 0.001 indicate that increasing the helium abundance in the envelope will enhance the blueward extent of the loops, particularly during the last several cycles. Dissert. Abstr.

N73-25857 Northwestern Univ., Evanston, Ill.
THE SPECTRAL CLASSIFICATION OF SOUTHERN CARBON STARS Ph.D. Thesis
Paul Martin Rybski 1972 168 p
Avail: Univ. Microfilms Order No. 72-32557

Well-widened objective prism spectra of carbon stars south of -25 deg declination have been examined to determine their suitability for classification. Compared with spectra of northern carbon stars taken with a one meter reflecting telescope and Cassegrain spectrograph at a grating reciprocal dispersion of 263 A/mm, and compared with spectra of several southern carbon stars, the objective prism spectra have been found of sufficient quality to support their classification into five groups. Dissert. Abstr.

N73-25858 State Univ. of New York, Albany.
A PULSAR MODEL BASED UPON THE TRANSITION TO TRIPLANAR SYMMETRY OF A RAPIDLY ROTATING MAGNETOSPHERE Ph.D. Thesis
Allen D. Jones 1972 92 p

Avail: Univ. Microfilms Order No. 72-31779
A review is given of some early thinking about the pulsar problem with particular emphasis on the model given by P. Goldreich and W. Julian. Particle drifts in a relativistic magnetosphere are considered and used to rederive electromagnetic perturbation formulas. The tensor virial method is used to study the stability of a rotating magnetosphere in the classical limit. A condition for the transition from rotational symmetry to triplanar symmetry is derived. The tensor virial method is extended to study the stability of a rotating magnetosphere including relativistic effects. A condition for the transition to triplanar symmetry is derived in which the relativistic mass of the magnetic field provides the moment of inertia. A conceptual scheme is used to apply the stability condition to a pulsar. For slow rotation the speed of light cylinder lies well beyond the boundary of the magnetosphere (terminated by the interstellar magnetic field). Dissert. Abstr.

N73-25859 Northwestern Univ., Evanston, Ill.
TWO COLOR PHOTOGRAPHIC SUPERPOSITION PHOTOMETRY OF LENTICULAR GALAXIES IN THE VIRGO CLUSTER Ph.D. Thesis
George Frederick Benedict 1972 213 p
Avail: Univ. Microfilms Order No. 72-32378

Density data for the images of twenty-seven galaxies were secured using a commercially available, automatic raster scanning microdensitometer. The four plates which were scanned were of two colors with one long and one short exposure of each. The resulting magnitudes calculated for each point of long and short exposure data were processed by combining the long and short data by a weighted average routine. The calibration procedure is critically discussed, as are microdensitometer response characteristics and their effects on the results. It is concluded that the microdensitometer is usuable in studies of this nature, except for regions of critically high density, and that the luminosity profiles of a galaxy provide a reasonable calibration for this type of photometry. Dissert. Abstr.

N73-25860 Virginia Univ., Charlottesville.
THE MOTIONS OF THE SATELLITES OF MARS FROM PHOTOGRAPHIC OBSERVATIONS MADE IN 1967, 1969 AND 1971 Ph.D. Thesis
Dan Pascu 1972 141 p
Avail: Univ. Microfilms Order No. 72-33379

The orbital parameters of the satellites of Mars were determined from photographic observations made in 1967 and a sampling of observations made in 1969 and 1971. All observations were made using a new technique. A small metallic film filter was used to diminish the light from Mars in order that a measurable image for the planetary disk be obtained as well as for the satellites. The plates were reduced using the faint background stars whose positions were determined from astrographic field plates. Dissert. Abstr.

N73-25861 California Inst. of Tech., Pasadena.
RADIATIVE PROCESSES IN AN INTENSE MAGNETIC FIELD Ph.D. Thesis
Donald Lionel Patrick Strange 1972 130 p
Avail: Univ. Microfilms Order No. 72-30834

Three astrophysical problems relating to the intense magnetic fields associated with neutron stars and white dwarfs are studied. (1) The radiation rate for nonrelativistic bremsstrahlung in 10 to the 12th power gauss is computed by both quantum-mechanical and classical methods. The main features of this emissivity are 1/pz dependence (magnetic field in the z-direction) characteristic of a one-dimensional momentum space. (2) The electron energy levels and orbits for hydrogen in 10 to the 12th power gauss are calculated with variational techniques. The ground state binding energy is found to be 200 ev. The overall electron density of the atom is elongated along the magnetic field direction. (3) Cyclotron emission and absorption in a magnetic field of 10 to the 8th power gauss is studied as a possible mechanism for the observed degree of circular polarization in the optical emission from white dwarfs. A few simple models explain some of the quantitative and qualitative aspects of the polarization data. Dissert. Abstr.

N73-25862 Brandeis Univ., Waltham, Mass.
INTERSTELLAR CLOUD COLLISIONS Ph.D. Thesis
Barry Leonard Werner 1972 115 p
Avail: Univ. Microfilms Order No. 72-32126

The collision between a very large and a small interstellar cloud is discussed. The penetration depth and the wake formed behind the small cloud is determined. For the collision speeds of astrophysical interest, the penetration depth is between 2 and 3 small cloud diameters and the wake is 1/2 the penetration depth. The conclusion is drawn that the presence of strong magnetic fields do not lead to elastic collisions, but rather, that cloud collisions involving large and small clouds result in the entrapment of the small cloud. Dissert. Abstr.

N73-25863 Harvard Univ., Cambridge, Mass.
RECOMBINATION LINE EMISSION FROM GALACTIC H 1 AND H 2 REGIONS Ph.D. Thesis
Diego Alberto Cesarky 1972 69 p
Avail: Univ. Microfilms Order No. 72-15055

The theoretical possibility of detecting radio combination lines from the sun and supernova remants in the H 1 and H 2 regions is investigated. Data cover the role played by collisional processes, ionized matter, and line radiation originating in the interstellar medium. Dissert. Abstr.

N73-25864 Purdue Univ., Lafayette, Ind.
VELOCITY OSCILLATIONS IN SOLAR PLAGE REGIONS Ph.D. Thesis
Cheng-Jen Norbert Chen 1972 142 p
Avail: Univ. Microfilms Order No. 72-30869

The properties of wave propagation in a perfectly electrically conducting, plane-stratified, inviscid, compressible atmosphere permeated by a horizontal magnetic field which varies with height are investigated. It is shown that a diagnostic diagram can be constructed through a generalization of the propagation equation to account for the presence of a magnetic field. The effect of the magnetic field on the oscillations in solar plages around nonmagnetic case based on the Bilderberg continuum atmosphere. Due to the joint action of ionization and the magnetic field, a potential well for internal gravity waves is formed. The properties of the trapped waves are in qualitative agreement with the observations. Dissert. Abstr.

N73-25865 California Inst. of Tech., Pasadena.
SYNTHESIS OF THE POLARIZATION PROPERTIES OF CYGNUS A AT 8300 AND 9600 MEGAHERTZ Ph.D. Thesis
Ka Bing Winson Yip 1972 150 p
Avail: Univ. Microfilms Order No. 72-30842

Methods of polarized interferometry were used in conjunction with the earth rotation aperture synthesis technique to study the polarized intensity distributions of Cygnus A at 8300 MHz and 9600 MHz. The total intensity distribution at 8300 MHz was also obtained. Although the resolutions obtained in these observations are about 20 in, it is still quite insufficient to reveal the structures in the components for a detailed comparison with theoretical models. The general feature of the ram pressure confinement mechanism, however, is consistent with this observation. The polarized distributions yield a rather fast variation of large rotation measures across the east component. There is also a reversal of the longitudinal magnetic field in the direction of the west component. Correlation with the distribution of small hydrogen clouds deduced from HI absorption measurements were discussed. There seems to be little depolarization across this source except in the bridge, and this is believed to be occurring outside of the emitting region. Dissert. Abstr.

N73-25866 California Inst. of Tech., Pasadena.
THERMAL RADIATION FROM THE GALILEAN SATELLITES MEASURED AT 10 AND 20 MICRONS Ph.D. Thesis
Olav Louis Hansen 1972 103 p
Avail: Univ. Microfilms Order No. 72-30803

The four Galilean Satellites were observed in two broad bandpasses, centered near 10 and 20 microns respectively, during Jupiter's 1971-apparition. Two types of measurements were obtained. The first consisted of monitoring the infrared flux as a function of each satellite's orbital position, the other of flux measurements during satellite eclipses. The flux measurements were obtained as a function of orbital position and were averaged for each satellite and bandpass. The mean values of each were

computed, and from these the thermal parameters were derived. Author

N73-25867*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ALFVEN WAVE REFRACTION BY INTERPLANETARY INHOMOGENEITIES
William D. Daily May 1973 27 p refs
(NASA-TM-X-62270) Avail: NTIS HC $3.50 CSCL 03B

Pioneer 6 magnetic data reveals that the propagation direction of Alfven waves in the interplanetary medium is strongly oriented along the ambient field. Magnetic fluctuations of frequencies up to 1/30 sec in the spacecraft frame are shown to satisfy a necessary condition for Alfven wave normal. It appears from this analysis that geometrical hydromagnetics may satisfactorily describe deviation of the wave normal from the background field. The rotational discontinuity is likely also to propagate along the field lines. Author

N73-25868*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEPENDENCE OF FIELD-ALIGNED ELECTRON PRECIPITATION ON SEASON, ALTITUDE AND PITCH ANGLE
F. W. Berko and R. A. Hoffman May 1973 30 p refs Submitted for publication
(NASA-TM-X-66260; X-646-73-153) Avail: NTIS HC $3.50 CSCL 03B

The occurrence of field-aligned 2.3 keV electron precipitation was examined by using data from more than 7500 orbits of the polar-orbiting satellite, OGO-4. The frequency of occurrence of field aligned precipitation was highest at actual pitch angles between 7 and 10 deg, being highest in the winter months, at highest satellite altitudes. Acceleration by a localized parallel electric field established by electrostatic charge layers is proposed to explain particle observations. Author

N73-25869*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
CELESCOPE CATALOG OF ULTRAVIOLET STELLAR OBSERVATIONS
Robert J. Davis, William A. Deutschman, and Katherine L. Haramundanis 1973 252 p refs Sponsored by NASA
(NASA-CR-132196) Avail: NTIS MF $1.45; SOD HC $4.85 Domestic Postpaid or $4.50 GPO Bookstore CSCL 03A

The catalog contains the observational results obtained by the Celescope Experiment during the first 16 months of operation of NASA's Orbiting Astronomical Observatory (OAO-2). It lists the results of the stellar observations, along with selected ground-based information obtained from the available literature. Lunar observations (Ahmad and Deutschman, 1972), as well as other analyses of the data, are being published as separate papers. These data are available in two forms: (1) magnetic tapes and the necessary utility programs for reading and printing the contents of the tapes; and (2) this catalog, transcribed from the magnetic-tape catalog. The magnetic tape version contains not only the compiled results but also the results of the individual observations from which these averaged data were compiled. Author

N73-25870*# Chicago Univ., Ill. Lab. for Astrophysics and Space Research.
DATA PROCESSING AND ANALYSIS FROM THE UNIVERSITY OF CHICAGO CHARGED PARTICLE EXPERIMENT ON THE OGO-5 SPACECRAFT Final Report
J. A. Simpson 25 May 1973 5 p refs
(Contract NAS5-9366)
(NASA-CR-132761) Avail: NTIS HC $3.00 CSCL 03B

The data processing and analysis performed for the charged particle experiment are summarized, and the principal scientific results obtained from the analysis are reported. A bibliography is included of conference reports, and publications based on these results is included. Author

N73-25871*# Singer-Kearfott, Pleasantville, N.Y.
VENUS WIND-ALTITUDE RADAR STUDY Final Report
Lester I. Goldfischer Jan. 1973 60 p refs
(Contract NAS2-7255)
(NASA-CR-114556; Y256E012) Avail: NTIS HC $5.00 CSCL 03B

A study was made of a wind/altitude radar for a Venus probe. The baseline configuration was taken to be the SKD-2100 Doppler radar modified to accommodate the altimeter portion of the APN-187 and a single beam antenna. Using current models of the Venus environment, engineering studies were made to define design requirements and to estimate the operational and physical characteristics of the conceptual design. The results of the study are that: (1) the radar instrument should have an altitude limit of at least 34 km for velocity and at least 17.5 km for altitude measurement, (2) vertical accuracy should be better than + or - 0.9 percent and horizontal velocity accuracy should be better than + or - 3 percent over the operating altitude range, and (3) altimeter accuracy should be within + or - 3 percent up to about 2.5 km and should improve over the remainder of the altimeter operating range. The radar is expected to require between 48.5 and 69.3 watts of power and to weigh between 3.86 and 5.21 kg (8.5 and 11.5 lb). In each case, if power could be supplied directly from the probe batteries the lower figures would apply; the upper figures would apply if a power conditioner must be used. Author

N73-25872*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE RADIATION ENVIRONMENT OF OSO MISSIONS FROM 1974 TO 1978
E. G. Stassinopoulos May 1973 196 p refs
(NASA-TM-X-66264; X-601-73-168) Avail: NTIS HC $12.00 CSCL 03B

Trapped particle radiation levels on several OSO missions were calculated for nominal trajectories using improved computational methods and new electron environment models. Temporal variations of the electron fluxes were considered and partially accounted for. Magnetic field calculations were performed with a current field model and extrapolated to a later epoch with linear time terms. Orbital flux integration results, which are presented in graphical and tabular form, are analyzed, explained, and discussed. Author

N73-25873*# Martin Marietta Corp., Denver, Colo.
STUDY OF APPLICATION OF ADAPTIVE SYSTEMS TO THE EXPLORATION OF THE SOLAR SYSTEM. VOLUME 1: SUMMARY Final Report
Mar. 1973 72 p ref
(Contract NAS1-11711)
(NASA-CR-132256; MCR-73-21-Vol-1) Avail: NTIS HC $5.75 CSCL 22A

The field of artificial intelligence to identify practical applications to unmanned spacecraft used to explore the solar system in the decade of the 80s is examined. If an unmanned spacecraft can be made to adjust or adapt to the environment, to make decisions about what it measures and how it uses and reports the data, it can become a much more powerful tool for the science community in unlocking the secrets of the solar system. Within this definition of an adaptive spacecraft or system, there is a broad range of variability. In terms of sophistication, an adaptive system can be extremely simple or as complex as a chess-playing machine that learns from its mistakes. Author

N73-25874*# Martin Marietta Corp., Denver, Colo.
STUDY OF APPLICATION OF ADAPTIVE SYSTEMS TO THE EXPLORATION OF THE SOLAR SYSTEM. VOLUME 2: SURVEY OF SOLAR SYSTEM MISSIONS Final Report
Mar. 1973 226 p refs
(Contract NAS1-11711)
(NASA-CR-132257; MRC-73-21-Vol-2) Avail: NTIS HC $13.50 CSCL 22A

Ways in which human intelligence might be simulated onboard an unmanned mission to achieve some of the decision making capability or adaptability of the manned mission are examined. The relative cost and simplicity advantages of the unmanned spacecraft missions are emphasized. Reliable techniques for making onboard decisions and for modifying mission science operations in response to the findings are analyzed. Author

N73-25875*# Martin Marietta Corp., Denver, Colo.
STUDY OF APPLICATION OF ADAPTIVE SYSTEMS TO THE EXPLORATION OF THE SOLAR SYSTEM. VOLUME 3: MARS LANDED SYSTEMS Final Report

Mar. 1973 230 p refs
(Contract NAS1-11711)
(NASA-CR-132258; MRC-73-21-Vol-3) Avail: NTIS HC $13.50 CSCL 22A

The results of a more detailed study of three missions to the surface of Mars: (1) an advanced lander, (2) a lander with a small tethered rover, and (3) a lander with a medium sized rover that operates independently of the lander for most of its functions but communicates with Earth through the lander are presented. For all three missions it was assumed that the Viking orbiter and lander would be used with modifications as required to improve the science package, to accommodate the rovers, and to handle the increased payloads. Author

N73-25876*# GCA Corp., Bedford, Mass. Technology Div.
MASS SPECTROMETRIC DETERMINATION OF THE COMPOSITION OF THE VENUS CLOUDS Final Report
R. F. K. Herzog Apr. 1973 25 p refs
(Contract NAS5-23099)
(NASA-CR-132766; GCA-TR-73-3-N) Avail: NTIS HC $3.25 CSCL 03B

The instrumentation is analyzed for determining the composition of the clouds on Venus. Direct analysis of the gas phase atmosphere, and the detection of ferrous chloride with a mass spectrometer are dicussed along with the mass analyzer, and the pre-separation of cloud particles from the ambient atmosphere. F.O.S.

N73-25877*# Analytical Mechanics Associates, Inc., Seabrook, Md.
TETHERED BODY PROBLEMS AND RELATIVE MOTION ORBIT DETERMINATION, PART 1 Final Report
J. B. Eades, Jr. and Henry Wolf Aug. 1972 189 p
(Contract NAS5-21453)
(NASA-CR-132757; Rept-72-35-Pt-1) Avail: NTIS HC $11.50 CSCL 22A

Selected problems dealing with orbiting tethered body systems were studied. In addition, a relative motion orbit determination program was developed. Results from these tasks are described and discussed. The expected tethered body motions were examined, analytically, to ascertain what influence would be played by the physical parameters of the tether, the gravity gradient and orbit eccentricity. After separating the motion modes these influences were determined; and, subsequently, the effects of oscillations and/or rotations, on tether force, were determined. A study was undertaken, by examining tether motions, to see what type of control actions would be needed to accurately place a mass particle at a prescribed position relative to a main vehicle. Other applications for tethers were studied. Principally these were concerned with the producing of low-level forces by means of stabilized tether configurations; and, the initiation of free transfer trajectories from tether supported vehicle relative positions. Author

N73-25878*# Illinois Univ., Urbana. Dept. of Astronomy.
THE RADIATION BELTS OF JUPITER Ph.D. Thesis
Joseph Jean Charles Degioanni 1973 132 p refs
(Grants NGR-14-005-176; NSF GP-8161)
(NASA-CR-132960) Avail: NTIS HC $8.75 CSCL 03B

A simplified model of the Jovian magnetosphere consists of a thermal plasma with superimposed radiation belts. The model is derived using the following assumptions: (1) The radiation belts are located in a cavity of the Jovian magnetosphere and the field geometry in that cavity is a pure dipole. (2) The conductivity in the Jovian ionosphere is large enough to force the magnetosphere to corotate. (3) The population of electrons in the radiation belts is in a steady state, and the observational data are representative of such average conditions. (4) The nonthermal continuum is produced by the synchrotron radiation of trapped relativistic electrons. Author

N73-25879*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
REMOTE ANALYSIS OF PLANETARY SOILS: X-RAY DIFFRACTOMETER DEVELOPMENT Final Report
John C. Gregory Apr. 1973 40 p refs
(Contract NAS8-27336)
(NASA-CR-124271) Avail: NTIS HC $4.00 CSCL 03B

A system is described suitable for remote low power mineralogical analysis of lunar, planetary, or asteroid soils. It includes an X-ray diffractometer, fluorescence spectrometer, and sample preparation system. A one Curie Fe-55 source provides a monochromatic X-ray beam of 5.9 keV. Seeman-Bohlin or focusing geometry is employed in the camera, allowing peak detection to proceed simultaneously at all angles and obviating the need for moving parts. The detector system is an array of 500-600 proportional counters with a wire-spacing of 1 mm. An electronics unit comprising preamplifier, postamplifier, window discriminators, and storage flipflops requiring only 3.5 milliwatts was designed and tested. Total instrument power is less than 5 watts. Powder diffraction patterns using a flat breadboard multiwire counter were recorded. Author

N73-25880*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
X-RAY ASTRONOMY FROM SOUNDING ROCKET AT MIT Final Report, 1 Sep. 1971 - 31 Aug. 1972
31 Aug. 1972 9 p refs
(Contract NSR-22-009-654)
(NASA-CR-133211) Avail: NTIS HC $3.00 CSCL 03A

The design and fabrication of scientific payloads are described, and results of astrophysical research are reported. Summaries of three Aerobee flights are included. F.O.S.

N73-25881*# California Inst. of Tech., Pasadena.
THE FLARES OF AUGUST 1972
Harold Zirin and Katsuo Tanaka [1972] 44 p refs
(Grant NGR-05-002-034)
(NASA-CR-132195; BBSO-0128) Avail: NTIS HC $4.25 CSCL 03A

Analysis is made of observations of the August, 1972 flares at Big Bear and Tel Aviv, involving monochromatic movies, magnetograms, and spectra. In each flare the observations fit a model of particle acceleration in the chromosphere with emission produced by impart and by heating by the energetic electrons and protons. The region showed twisted flux and high gradients from birth, and flares appear due to strong magnetic shears and gradients across the neutral line produced by sunspot motions. Post flare loops show a strong change from sheared, force-free fields parallel to potential-field-like loops, perpendicular to the neutral line above the surface. Author

N73-25882*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 17 MISSION. LUNAR ROVING VEHICLE/ TRAVERSE GRAVIMETER EXPERIMENT MOTION SENSITIVITY
Apr. 1973 37 p
(Proj. Apollo)
(NASA-TM-X-69268; JSC-07948) Avail: NTIS HC $4.00 CSCL 03B

The results of the lunar roving vehicle/traverse gravimeter experiment motion sensitivity test shows that the gravity measurements in both the normal and bypass modes should not be adversely affected by motion induced in the lunar roving vehicle by operation of the television camera position drive device or the operation of the surface electrical properties receiver/ recorder. Motion of the traverse gravimeter experiment occurred when a 1.4-hertz resonant mode in pitch of the pallet was excited. Both of these modes were excited by camera elevation changes with the camera axis positioned fore and aft. Author

N73-25554* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APPLICATION OF COHERENT OPTICAL MATCHED FILTERING FOR DETECTION OF METEOR TRAILS
T. H. Gee (Tenn. Univ. Space Inst.), C. W. Allen (Tenn. Univ. Space Inst.), and K. S. Clifton *In its* Holography and Opt. Filtering 1973 p 145-148 refs (For availability see N73-25540 16-16)
(Contract NAS8-24393)
CSCL 03B

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N73-25883 Stanford Univ., Calif.
GRAVITATIONAL STABILIZATION OF TWO-BODY SATELLITES Ph.D. Thesis
Robert Hillsman Cronin 1972 222 p
Avail: Univ. Microfilms Order No. 72-30616

A satellite consisting of two rigid bodies connected by a simple hinge joint is described. It is assumed that the mass center of the entire satellite travels in a circular orbit, and that the dimensions of the satellite are small compared to the orbit radius. In the derivation of full nonlinear equations of motion, components of angular velocity and Euler parameters are used to deal with the attitude motion of the main body of the satellite, and the motion of the auxiliary body is described relative to the main body. Linear stability analyses are presented for four particular satellite configurations using passive elements (springs and dampers) for attitude control. Complete stability conditions are obtained, and these are then expressed simply in terms of physically meaningful inertia parameters. Dissert. Abstr.

N73-25884# Committee on Aeronautical and Space Sciences (U. S. Senate).
SKYLAB
Washington GPO 1973 37 p Hearing on status of Skylab mission before Comm. on Aeron. and Space Sci., 93d Congr., 1st Sess., 23 May 1973
Avail: Comm. on Aeron. and Space Sci.

A hearing before the Committee on Aeronautical and Space Sciences of the United States Senate concerning the Skylab program is presented. The hearing was conducted to determine the nature of the Skylab 1 malfunction and proposed steps to correct the malfunction. Diagrams of the Skylab vehicle and its components are illustrated to show the occurrence of the malfunction. Various concepts for correcting the problem are proposed. The report is comprised primarily of testimony from engineering personnel assigned to the Skylab program. P.N.F.

N73-25885*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ATLAS/CENTAUR PIONEER G OPERATIONS SUMMARY
2 Apr. 1973 43 p
(NASA-TM-X-69267; KSC-TR-1230) Avail: NTIS HC $4.25 CSCL 22C

Specifications of the Pioneer G and Atlas/Centaur 30 Launch Vehicle are provided, along with information concerning mission objectives. The Atlas/Centaur engine group will generate a 431,383 lb. thrust for an injection velocity of approximately 32,400 miles per hour using liquid oxygen and RP-1 propellants. In addition to detailed diagrams of equipment aboard the Pioneer G, an account is given of intended investigations of the interplanetary medium beyond the orbit of Mars, the nature of the asteroid belt, and the environmental and atmospheric characteristics of Jupiter. Pertinent data regarding the option of a Saturn-oriented trajectory are also reviewed and evaluated. J.M.M.

N73-25886*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH ROCKET TEST RR-1 (BLACK BRANT VC) AND RR-2 (AEROBEE 170A): INVESTIGATIONS OF THE STABILITY OF BUBBLES IN PLAIN AND FIBER-REINFORCED METAL AND SOLIDIFIED IN A NEAR-ZERO-g ENVIRONMENT
I. C. Yates and Vaughn H. Yost Jun. 1973 67 p Revised
(NASA-TM-X-64665) Avail: NTIS HC $5.50 CSCL 19G

The results of the first two of a series of research rocket flights are presented. The objectives of these flights were (1) to learn about the capabilities of these rockets, (2) to learn how to interface the payloads and rockets, and (3) to process some of the composite casting demonstration capsules intended originally for Apollo 15. The capsules contained experiments for investigating the stability of gas bubbles in plain and fiber-reinforced metal melted and solidified in a near-zero-g (0.0119g) environment. The characteristics of the two research rockets, an Aerobee 170A and a Black Brant VC, used to obtain the periods of near-zero-g and the temperature control unit used for processing the contents of the two experiment capsules are discussed. Author

N73-25887*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: CREW STATION INTEGRATION. VOLUME 5: LIGHTING CONSIDERATIONS
Charles D. Wheelwright Washington Jun. 1973 24 p refs 5 Vol.
(NASA-TN-D-7290; MSC-S-360-Vol-5) Avail: NTIS HC $3.00 CSCL 22B

The lighting requirements for the Apollo spacecraft are presented. The natural lighting factors are discussed in terms of major constraints. A general description of the external and internal lighting systems for the command and lunar modules is presented with a discussion of the primary approach and design criteria followed during development. Some of the more difficult problems encountered during the implementation of a new lighting system are reviewed. Author

N73-25888*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: GUIDANCE AND CONTROL SYSTEMS - DIGITAL AUTOPILOT DESIGN DEVELOPMENT
William H. Peters and Kenneth J. Cox Washington Jun. 1973 47 p refs
(NASA-TN-D-7289; MSC-S-331) Avail: NTIS HC $3.00 CSCL 22B

The development of the Apollo digital autopilots (the primary attitude control systems that were used for all phases of the lunar landing mission) is summarized. This report includes design requirements, design constraints, and design philosophy. The development-process functions and the essential information flow paths are identified. Specific problem areas that existed during the development are included. A discussion is also presented on the benefits inherent in mechanizing attitude-controller logic and dynamic compensation in a digital computer. Author

N73-25889*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: THE CRYOGENIC STORAGE SYSTEM
William A. Chandler, Robert R. Rice, and Robert K. Allgeier, Jr. Washington Jun. 1973 17 p
(NASA-TN-D-7288; MSC-S-321) Avail: NTIS HC $3.00 CSCL 22B

A review of the design, development, and flight history of the Apollo cryogenic storage system and of selected components within the system is presented. Discussions are presented on the development history of the pressure vessels, heaters, insulation, and selected components. Flight experience and operational difficulties are reported in detail to provide definition of the problems and applicable corrective actions. Author

N73-25890*# Business and Technological Systems, Inc., Seabrook, Md.
ESTIMATION AND IDENTIFICATION STUDY FOR FLEXIBLE VEHICLES
Andrew H. Jazwinski and Thomas S. Englar, Jr. May 1973 61 p refs
(Contract NAS1-11652)
(NASA-CR-132262; BTS-TR-73-3) Avail: NTIS HC $5.25 CSCL 22B

Techniques are studied for the estimation of rigid body and bending states and the identification of model parameters associated with the single-axis attitude dynamics of a flexible vehicle. This problem is highly nonlinear but completely observable provided sufficient attitude and attitude rate data is available and provided all system bending modes are excited in the observation interval. A sequential estimator tracks the system

states in the presence of model parameter errors. A batch estimator identifies all model parameters with high accuracy. Author

N73-25891*# Martin Marietta Corp., Denver, Colo.
DESIGN, DEVELOP AND TEST HIGH TEMPERATURE DYNAMIC SEALS FOR THE SPACE SHUTTLE'S AERODYNAMIC CONTROL SURFACES Final Report
Jun. 1973 139 p refs
(Contract NAS9-12883)
(NASA-CR-128951; MCR-73-116) Avail: NTIS HC $9.00 CSCL 22B

A description is given of the design, development and testing of high temperature dynamic seals for the gaps between the structure and aerodynamic control surfaces on the space shuttle. These aerodynamic seals are required to prevent high temperature airflow from damaging thermally unprotected structures and components during entry. Two seal concepts evolved a curtain seal for the spanwise elevon cove gap, and a labyrinth seal for the area above the elevon, at the gap between the end of the elevon and the fuselage. On the basis of development testing, both seal concepts were shown to be feasible for controlling internal temperatures to 350 F or less when exposed to a typical space shuttle entry environment. The curtain seal concept demonstrated excellent test results and merits strong consideration for application on the space shuttle orbiter. The labyrinth seal concept, although demonstrating significant temperature reduction characteristics, may or may not be required on the Orbiter, depending on the actual design configuration and flight environment. Author

N73-25892*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
QUALITATIVE INVESTIGATION OF BOOSTER RECOVERY IN OPEN SEA
Preston E. Beck 1 Mar. 1973 74 p Revised
(NASA-TM-X-69273; KSC-TR-1195-Rev-1) Avail: NTIS HC $5.75 CSCL 22C

Limited tests were conducted using 1/27 scale model of a Titan 3C booster plus 1/32.9 and 1/15.6 scale models of a solid rocket booster case to establish some of the characteristics that will effect recovery operations in open seas. This preliminary effort was designed to provide additional background information for conceptual development of a waterborne recovery system for space shuttle boosters, pending initiation of comprehensive studies. The models were not instrumented; therefore, all data are qualitative (approximations) and are based on observations plus photographic coverage. Author

N73-25893*# Martin Marietta Corp., Denver, Colo.
NEUTRAL BUOYANCY TESTING OF A SHUTTLE ORBITER CREW COMPARTMENT Summary Report
A. A. Rosener and M. L. Stephenson May 1973 21 p
(Contract NAS9-11947)
(NASA-CR-128949; MSC-03774-Add-1) Avail: NTIS HC $3.25 CSCL 22B

The architectural and man-machine aspects of a shuttle orbiter crew compartment were examined. All phases of the Orbiter's flight mode from launch through zero gravity, reentry, and ferry flight are considered. The data provides an initial design criteria that treats the crew compartment as a total system and provides data that has a direct contribution to the development of flight hardware. Primary interest was centered on the design of the galley, hygiene facility, passenger couches, airlock, work station, and flight deck access. The man-machine interface emphasis was placed on identifying and developing solutions for problems in mobility/restraint, ingress/egress, accessibility, and volume utilization. Author

N73-25894*# Martin Marietta Corp., Denver, Colo.
NEUTRAL BUOYANCY TESTING OF A SHUTTLE ORBITER CREW COMPARTMENT Final Report
M. L. Stephson and A. A. Rosener May 1973 162 p
(Contract NAS9-11947)
(NASA-CR-128950; MSC-03773-Add-1) Avail: NTIS HC $10.25 CSCL 22B

For abstract, see N73-25893

N73-25895*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
MILLIMETER WAVE EXPERIMENT FOR ATS-F Final Report
J. S. Green, R. N. Parisky, and S. S. Shapiro May 1973 149 p refs
(Contract NAS5-21075)
(NASA-CR-132760; HS-330-3348-50; SCG-30153R) Avail: NTIS HC $9.50 CSCL 22A

A detailed description of spaceborne equipment is provided. The equipment consists of two transmitters radiating signals at 20 and 30 GHz from either U.S. coverage horn antennas or a narrow beam parabolic antenna. Three modes of operation are provided: a continuous wave mode, a multitone mode in which nine spectral lines having 180 MHz separation and spaced symmetrically about each carrier, and a communications mode in which communications signals from the main spacecraft transponder are modulated on the two carriers. Detailed performance attained in the flight/prototype model of the equipment is presented both under laboratory conditions and under environmental extremes. Provisions made for ensuring reliability in space operation are described. Also described the bench test equipment developed for use with the experiment, and a summary of the new technology is included. Author

N73-25896*# General Electric Co., Schenectady, N.Y.
ATS RANGING AND POSITION FIXING EXPERIMENT, PHASE 3 Final Report, 19 Mar. 1971 - 1 Dec. 1972
Roy E. Anderson 1 Dec. 1972 118 p refs
(Contract NAS5-11634)
(NASA-CR-132755; SRD-73-062) Avail: NTIS HC $8.00 CSCL 22A

The experiments to test the concept of position location by range measurements from pairs of satellites in the L-band using ATS-5 are reported. Results of the ranging experiments confirmed that ranging resolution measured in tens or hundreds of feet may be achieved at VHF and L-band within the radio frequency bandwidths used for communications with simple, inexpensive, automatic equipment. F.O.S.

N73-25897# Lockheed Missiles and Space Co., Palo Alto, Calif.
NONSTATIONARY THREE-DIMENSIONAL MOTION OF A FLYING VEHICLE ENTERING THE ATMOSPHERE AT HYPERSONIC VELOCITY
V. A. Grobov and A. V. Kotsiuba [1973] 9 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 8, no. 12, 1973 p 71-79
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A numerical analysis of the nonstationary three dimensional motion of a flying vehicle entering the atmosphere at hypersonic velocity is presented. The solution permits the investigation of essentially nonlinear fluctuations of the flying vehicle in angle of attack. Mathematical models are developed to clarify the theoretical concepts. Graphs characterizing the time change in the longitudinal angular velocity and angle of attack are represented. Author

N73-25898*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
RENDEZVOUS TARGETING FOR SPACE MISSIONS
Wayne H. Templeman Sep. 1972 25 p refs
(Contract NAS9-10268; DSR Proj. 55-40800)
(NASA-CR-128963; E-2713) Avail: NTIS HC $3.25 CSCL 22A

A brief outline of a targeting program for use in the space shuttle mission is presented. This general purpose program can accept a large variety of constraints and can be applied to each maneuver sequence contained in the rendezvous sequence. It consists of a main program which automatically and sequentially calls a general maneuver subroutine to compute each maneuver segment contained in the maneuver sequence. Author

N73-25899# Lockheed Propulsion Co., Redlands, Calif.
A PRELIMINARY LITERATURE SEARCH AND BIBLIOGRAPHY SUPPORTING THE DEVELOPMENT OF A SPACE SHUTTLE SOLID ROCKET BOOSTER WATER RECOVERY

SYSTEM
John L. Deuble, Jr. Mar. 1973 142 p refs
(LPC-Doc-SRM-143) Avail: NTIS HC $9.25

To support studies on the technical rationale and integrated system approach for the development of a space shuttle booster water recovery system, a preliminary search of the existing technical literature was performed. The scope of this effort included retrospective search of established data banks that have computerized information retrieval capabilities, and contact with selected Government, academic, and private organizations that specialize in the conduct of studies pertaining to oceanography, ocean engineering, and fluid mechanics/hydrodynamics. Literature sought was restricted to the time period 1969-1972. One data bank was searched for the period 1968-1972. As a result of this activity, an extensive bibliography was prepared under the topical heading Methods and Equipment for Towing and Recovery of Floating Objects at Sea. Author

N73-25900*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN ANALYSIS OF ATMOSPHERIC ENTRY TRAJECTORIES FOR MANNED AND UNMANNED MISSIONS TO THE PLANET VENUS
Mark K. Craig and Ralph G. Gonzalez Washington Jun. 1973 44 p refs
(NASA-TN-D-7316; MSC-S-212) Avail: NTIS HC $3.00 CSCL 22A

A unified atmospheric density model is presented for the planet Venus, and this model is compatible with Russian and American data obtained during the 1967 Venus launch opportunity. Trajectory characteristics involved in atmospheric entry are discussed with reference to roll-control modulation and entry corridor. Subsequent to a trajectory-oriented discussion of potential Venus mission characteristics, a parametric analysis of manned and unmanned vehicle entry trajectories into the Venusian atmosphere is presented. A sensitivity analysis with reference to atmospheric density deviations is included to show the dependence of corridor depth on the atmospheric density profile. Author

N73-25901*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: COMMAND AND SERVICE MODULE REACTION CONTROL SYSTEMS
Ralph J. Taeuber and Dwayne P. Weary Washington Jun. 1973 54 p ref
(NASA-TN-D-7151; MSC-S-336) Avail: NTIS HC $3.00 CSCL 22B

The reaction control systems of the Apollo command and service module were developed and modified between July 1961 and July 1969. The successful development of these systems, as part of the Apollo Program, was the result of extensive testing, retesting, and modifications of the hardware to ensure system capability and intrasystem compatibility. Author

N73-25902*# Boeing Aerospace Co., Seattle, Wash.
LIGHTWEIGHT EVACUATED MULTILAYER INSULATION SYSTEMS FOR THE SPACE SHUTTLE VEHICLE Final Report, 12 Apr. 1971 - 31 Aug. 1972
D. L. Barclay, J. E. Bell, and D. K. Zimmerman May 1973 256 p refs
(Contract NAS3-14369)
(NASA-CR-121105; D180-15171) Avail: NTIS HC $15.00 CSCL 22B

The elements in the evacuated multilayer insulation system were investigated, and the major weight contributors for optimization selected. Outgassing tests were conducted on candidate vacuum jacket materials and experiments were conducted to determine the vacuum and structural integrity of selected vacuum jacket configurations. A nondestructive proof test method, applicable to externally pressurized shells, was validated on this program. Author

N73-25903*# Scientific Translation Service, Santa Barbara, Calif.
SPACECRAFT CONTROL SYSTEMS
A. S. Korovkin Washington NASA May 1973 102 p refs Transl. into ENGLISH of the book "Sistemy Upravleniya Kosmicheskikh Apparatov" Moscow, Military Press, 1972 87 p
(Contract NASw-2483)
(NASA-TT-F-774) Avail: NTIS HC $3.00 CSCL 22B

The characteristics of spacecraft control systems are described. Emphasis is placed on the control, attitude control, and stabilization systems. The application of sensors, analog computers, and logic devices, and auxiliary mechanisms is analyzed. Manual control as well as the particular cases of automatic control are examined in cases where a human performs logic functions in the automatic control system. Author

N73-25904*# Exotech Systems, Inc., Falls Church, Va.
EFFECTS OF WSMR IMPACT DATA ON RELEASE PARAMETER EVALUATION Interim Report
Mar. 1973 12 p refs
(Contract NASw-2372)
(NASA-CR-131835; TR73-I-01) Avail: NTIS HC $3.00 CSCL 16B

The phenomenon of high velocity, crash landing of spacecraft on the surface of a planet is analyzed as a potential mechanism for the release of encapsulated microbial burden. One of the key factors in this analysis is the extent of fracturing of the spacecraft material. From theoretical considerations it is postulated that the degree of fracturing depends upon such factors as the impact velocity experienced, the physical properties of the surface and of the spacecraft material, the angle of incidence with the surface, and the prevailing atmospheric conditions. Of these, the impact velocity is generally felt to be the dominant factor in the determination of the extent of fracturing. Author

N73-25905*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
A NEW APPROACH TO THE DESIGN OF TIME VARYING CONTROL SYSTEMS WITH APPLICATION TO THE SPACE SHUTTLE BOOSTER
R. V. Ramnath May 1973 22 p refs
(Contract NAS9-4065)
(NASA-CR-128972; E-2765) Avail: NTIS HC $3.25 CSCL 22B

A general approach toward the analysis and design of closed loop control for slowly time-varying linear systems was investigated. The approach is by the method of generalized multiple scales, in which slow and fast dynamics are systematically separated by employing different clocks which measure time at varying rates. The clocks, which are necessarily nonlinear functions of time, so that the system dynamics are asymptotically invariant with respect to the new time scale. A transfer function relating the output to the input for general linear slowly time-varying systems is developed and represents the actual system under certain conditions. The clock functions are shown to satisfy an algebraic characteristic equation and can be determined in general in terms of the coefficients. Author

N73-25906*# IIT Research Inst., Chicago, Ill.
SATURN ORBITER MISSION STUDY
William C. Wells and Roger J. Sullivan Jan. 1973 102 p refs
(Contract NASw-2144)
(NASA-CR-133033; M-36) Avail: NTIS HC $7.25 CSCL 22A

A preliminary analysis of the important aspects of missions orbiting the planet Saturn is provided. Orbital missions to Saturn is given serious consideration for the 1980's, or after flybys by Pioneer 10/G and Mariner Jupiter-Saturn 1977. An attempt is made to characterize Saturn orbiters in detail so that comparisons with Jupiter missions can be made. The scientific objectives of Saturn exploration are grouped under four topics: (1) the atmosphere, (2) the magnetosphere, (3) the rings, and (4) the satellites. Author

N73-25907*# Analytical Mechanics Associates, Inc., Seabrook, Md.
OPTIMUM SOLAR ELECTRIC INTERPLANETARY MISSION OPPORTUNITIES FROM 1975 TO 1990
F. I. Mann and J. L. Horsewood Dec. 1971 490 p refs
(Contract NAS5-11364)
(NASA-CR-132765; Rept-71-44) Avail: NTIS HC $26.50 CSCL 22A

A collection of optimum trajectory and spacecraft data is presented for unmanned interplanetary missions from 1975 to

1990 using solar electric propulsion. Data are presented for one-way flyby and orbiter missions from Earth to Venus, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. The solar system model assumes planetary ephemerides which very closely approximate the true motion of the planets. Direct and indirect flight profiles are investigated. Data are presented for two representative flight times for each mission. The launch vehicle is the Titan 3 B (core)/Centaur, and a constant jet exhaust speed solar electric propulsion system having a specific mass of 30 kg/kw is completely optimized in terms of power level and jet exhaust speed to yield maximum net spacecraft mass. The hyperbolic excess speeds at departure and arrival and the launch date are optimized for each mission. For orbiter missions, a chemical retro stage is used to brake the spacecraft into a highly eccentric capture orbit about the target planet. Author

N73-25908*# California Univ., Los Angeles. Mechanics and Structures Dept.
DYNAMICS AND CONTROL OF ADVANCED SPACE VEHICLES, VOLUME 1
Peter W. Likins Apr. 1973 53 p refs
(Contract NAS8-28358)
(NASA-CR-124272; UCLA-ENG-7329) Avail: NTIS HC $4.75 CSCL 22B

The following studies are reported: (1) Modal analyses of elastic continua for Liapunov stability analysis of flexible spacecraft; (2) development of general purpose simulation equations for arbitrary spacecraft; (3) evaluation of alternative mathematical models for elastic components of spacecraft; and (4) examination of the influence of vehicle flexibility on spacecraft attitude control system performance. Author

N73-25909*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 17 MISSION. MAPPING CAMERA EXTENSION MECHANISM OPERATED ERRATICALLY Anomaly Report No. 2
Apr. 1973 18 p
(NASA-TM-X-69269; JSC-07954) Avail: NTIS HC $3.00 CSCL 22B

The erratic operation of the mapping camera assemblies on board Apollo 15, 16, 17 is investigated. The exact causes of the problems with the scientific equipment module deployment mechanisms are not identified. However, the possibility of increased friction in hard vacuum is implied. It is suggested that since hard vacuum conditions are not attainable in large chambers, realistically loaded components could be tested in small chambers capable of vacuums to 10 to the minus 14th power torr. It is concluded that this technique carries with it the greatest promise for future investigations. Author

N73-25910*# Alabama Univ., Huntsville.
IMAGE PROCESSING TECHNIQUES AND APPLICATIONS TO THE EARTH RESOURCES TECHNOLOGY SATELLITE PROGRAM Final Technical Report
R. J. Polge, B. K. Bhagavan, and L. Callas May 1973 121 p refs
(Contract NAS8-28545)
(NASA-CR-124285; UAH-RR-141) Avail: NTIS HC $8.25 CSCL 14E

The Earth Resources Technology Satellite system is studied, with emphasis on sensors, data processing requirements, and image data compression using the Fast Fourier and Hadamard transforms. The ERTS-A system and the fundamentals of remote sensing are discussed. Three user applications (forestry, crops, and rangelands) are selected and their spectral signatures are described. It is shown that additional sensors are needed for rangeland management. An on-board information processing system is recommended to reduce the amount of data transmitted. Author

N73-25911# Oklahoma Univ., Norman.
DYNAMICS OF SOUNDING ROCKETS AT BURNOUT
William C. Womack, C. W. Bert, and F. J. Perdreauville (Sandia Labs., Albuquerque, N. Mex.) [1972] 41 p refs Sponsored by AEC
(SC-DC-72-1613; Conf-730303-1) Avail: NTIS

An outline of a new tool is presented for the sounding rocket development engineer. It is an integrated method that allows the engineer to determine the effect of various perturbing moments on the oscillatory motion of the vehicle. Furthermore, since the engineer requires a point-mass trajectory aerodynamic pitching and damping coefficients and an aeroelastic analysis for the basic design of the vehicle, the oscillatory analysis can be done with very little extra effort. The analysis of the Nitehawk 9 by this method simulates the actual flight data very closely. Author

N73-25912# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES, JANUARY 1973
R. D. Eberst 12 Feb. 1973 20 p
(ROE-STS-141) Avail: NTIS HC $3.00

Stopwatch observations made at stations during Jan. 1973 are listed in launch and time order for each satellite. Various subtotals are given. Author (ESRO)

N73-25913# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
OPTIMISATION OF GEOSTATIONARY SATELLITE EMPLACEMENT BY LOW THRUST PROPULSION
R. Holdaway and R. E. W. Jansson Sep. 1972 62 p refs
(AASU-323) Avail: NTIS HC $5.25

Optimal transfer of communications satellites to geostationary orbit from parking orbit by low thrust electrical propulsion was studied with the aid of a general trajectory program which takes into account the major relevant perturbations and mission variables. One case, that of resistojet motors deriving their power from solar cell arrays, was examined in numerical detail. It is shown that for optimal transfer the parking orbit altitude should be about 350 km when the nonpropulsive payload is about 32% of the parking orbit mass. Since transfer through the Van Allen belt degrades the performance of the power source, this is a major variable which was studied. It was found that mission efficiency increases (and propulsion system cost per mission decreases) if the propulsion system is sized for the power available at start of mission and is allowed to run off-design as the power falls. Author (ESRO)

N73-25914# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
SIMULATION STUDIES OF MISSILE AND ROCKET SYSTEMS Final Report on Test Operations Procedure
30 Nov. 1972 23 p refs
(AMCR Proj. 310-6)
(AD-759226; TOP-5-1-030) Avail: NTIS CSCL 16/4

The report presents simulation procedures for engineering type test of missile and rocket systems. It identifies the types of simulators. It discusses the value and use of simulation studies in missile flight safety, test planning, development of test plans, and analysis of test results. The report provides procedures for defining the simulation review of contractor math model, construction of mathematical model, programming the chosen computer, debugging model and/or computers, and the use of computers (digital, analog, and hybrid). Appendixes discuss terminology and computer system advantages and disadvantages by type. Author (GRA)

N73-25915# Technology, Inc., Dayton, Ohio.
ANALYTICAL PITCH DAMPING OF SLENDER ABLATING CONES IN THE PRESENCE OF THERMODYNAMIC LAG Final Report, Feb. - Aug. 1972
K. J. Orlik-Ruckemann Wright-Patterson AFB, Ohio ARL Mar. 1973 66 p refs
(Contract F33615-71-C-1463; AF Proj. 7065)
(AD-759186; ARL-73-0042) Avail: NTIS CSCL 16/3

The author's theory of dynamic viscous pressure interaction has been extended to cases with surface ablation by sublimation. It has been shown that the two very large and opposite effects of aftbody ablation and forebody ablation on pitch damping of a slender body, which were observed experimentally, can be predicted by this extended theory using approximately the same value of an important parameter known as the thermodynamic time lag. It is suggested that further studies on the ablation of slender re-entry vehicles or missiles should center on the

determination of the magnitude of that thermodynamic effect. (Author Modified Abstract) GRA

N73-25916# TRW Systems Group, Redondo Beach, Calif.
DEVELOPMENT OF FLIGHT UNITS FOR THE THERMAL CONTROL COATINGS EXPERIMENT Final Report, May 1971 - Sep. 1972
E. E. Luedke and L. R. Kelley Wright-Patterson AFB, Ohio AFML Oct. 1972 145 p
(Contract F33615-71-C-1448; AF Proj. 7340)
(AD-759083; TRW-18595; AFML-TR-72-233) Avail: NTIS CSCL 11/3

The objective of the program is to design, fabricate, and test experimental flight packages capable of measuring the long term degradation of solar absorptance of thermal control coatings (TCC) in the space environment. Use of these highly accurate flight units will allow correlation of the performance of experimental TCC in the actual space environment with that exhibited in laboratory in situ simulated space environments. Six experiment packages capable of testing eight TCC surfaces each on an orbiting spacecraft have been developed. Each package weighs 430 grams, consumes 350 mw of power, operates from 28 plus or minus 5V, and provides a 0-5 V telemetry output with an overall accuracy of plus or minus 1F. A prototype flight unit successfully passed thermal cycling, shock, vibration and humidity test qualifications. Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-25917 Polytechnic Inst. of Brooklyn, N.Y.
ANALYSIS OF A PERFORATED CIRCULAR CYLINDRICAL SHELL SUBJECTED TO AXIAL TENSION, EDGE MOMENT ON TRANSVERSE SMEAR Ph.D. Thesis
Richard C. Mondello 1972 96 p
Avail: Univ. Microfilms Order No. 72-28263

The method of least square point matching is employed in the analysis of a shallow, circular cylindrical shell with a cutout. The cylinder may be infinite or semi-infinite, and the cutout is either circular or elliptic. For the ellipse the major axis can be oriented whether parallel or perpendicular to the generator. In particular, two examples are presented: an infinite cylinder subjected to uniform axial tension, and a semi-infinite cylinder loaded at its edge by either a uniform bending moment or a transverse shear force. In both cases the minor axis of the elliptic cutout is parallel to the generator: The boundary of the perforation is free of tractions and supports. Numerical results are presented and show the effects of variations in: the hole size to cylinder curvature ratio; the eccentricity of the cutout; and for semi-infinite cylinders, the distance from the cutout to the edge.
Dissert. Abstr.

N73-25918 Polytechnic Inst. of Brooklyn, N.Y.
VIBRATIONS OF THICK ORTHOTROPIC CIRCULAR CYLINDRICAL SHELLS Ph.D. Thesis
Alan Paul Salzman 1972 106 p
Avail: Univ. Microfilms Order No. 72-28280

Higher order shell equations are developed for thick, orthotropic, circular cylinders undergoing axially symmetric, non-torsional, harmonic motion. Systems of governing equations for three, five, seven and nine mode theories are obtained from Reissner's variational principle by assuming stress and displacement states which include higher order terms through the shell thickness. Frequency spectrums and mode shapes obtained from the soiution of the resulting generalized characteristic-value problems are presented and compared to known elasticity solutions. Dissert. Abstr.

N73-25919 Lehigh Univ., Bethlehem, Pa.
LARGE AMPLITUDE WAVES IN BOUNDED MEDIA Ph.D. Thesis
Huseyin Murat Cekirge 1972 144 p
Avail: Univ. Microfilms Order No. 72-25865

Techniques which can be used to analyze the interaction of large amplitude elastic waves in a bounded medium are described. Although presented in the context of uniaxial stretching deformations in an elastic string or bar, these techniques can be used to analyze the behavior of any system whose response is described by the nonlinear one-dimensional wave equation. The bounded medium is contained between two parallel planes which separate it from other similar media. These are semi-infinite and extend along the axis of propagation which is normal to the interfaces.
Dissert. Abstr.

N73-25920 Polytechnic Inst. of Brooklyn, N.Y.
THERMAL STRESSES IN RING-REINFORCED OVAL CYLINDRICAL SHELLS Ph.D. Thesis
Brice Nicholas Cassenti 1972 148 p
Avail: Univ. Microfilms Order No. 72-28214

The thermal stresses induced in ring-reinforced oval cylindrical shells, subject to various heat inputs are presented. The problem is divided into two main sections: (1) determination of the transient and steady state temperature distribution on the oval shell, and (2) calculation of the resulting thermal stresses. In the temperature problem, two heating rates are considered. One is a uniform linear heat transfer rate and the second is a step-wise constant rate in the circumferential direction. Throughout the analysis, temperature distributions that are a function of the circumferential coordinate only are considered. In the thermal stress problem equations of the Love-type and Donnell-type are considered. The boundary conditions enforced correspond to a ring-reinforced shell. Computations, for selected parameters, were carried out on an IBM 360/50 and are presented graphically. Dissert. Abstr.

N73-25921 Purdue Univ., Lafayette, Ind.
ELASTIC-PLASTIC STRESS ANALYSIS OF LARGE AXISYMMETRICALLY DEFLECTED SHALLOW THIN SHELLS OF REVOLUTION Ph.D. Thesis
Charles Alan Hansen 1972 155 p
Avail: Univ. Microfilms Order No. 72-30901

The practical necessity for determining the residual stresses placed into a pressure displacement converter diaphragm during manufacture was the motivation for this study. The pressure displacement converter consists of a thin sheet of steel welded into a housing to form a diaphragm on top of which a pressure can be applied to cause a deflection of the diaphragm and the piston which is in contact with the lower side of the diaphragm. After assembly, the converter undergoes a pressure load several times the operating load and causes permanent deformation and induced residual stresses. These residual stresses play an important role in the life of the valve while the permanent deformation influences the operating characteristic. The constitutive, equilibrium, and compatibility equations capable of modeling the effects of the manufacturing process on the system are developed.
Dissert. Abstr.

N73-25922 Connecticut Univ., Storrs.
A PHENOMENOLOGICAL ANALYSIS OF THE INTERACTION OF CREEP AND FATIGUE Ph.D. Thesis
Arnold Eugene Carden 1972 170 p
Avail: Univ. Microfilms Order No. 72-32207

A literature review surveys the phenomenological analyses of time and cycle dependent fracture at elevated temperature. The log time-to-failure versus log cycles-to-failure diagram proposed by Esztergar is analysed and related to other predictive schemes. The frequency dependent crack growth data reported by James, Coles and Popp, and Solomon are analyzed to show the potential of applying fatigue crack growth to the creep-fatigue fracture problem. A survey of current test methods cites the various schemes that have been used to study the interaction of creep and fatigue. A crack growth equation is shown to represent most of the available data. Alternate forms of this equation can be derived from plastic strain range controlled fatigue crack growth by use of a given strain intensity function.
Dissert. Abstr.

N73-25923 Texas Univ., Arlington.
NONLINEAR VIBRATIONS OF ROTATING BLADES Ph.D. Thesis

Charuddin Akbar Ansari 1972 205 p
Avail: Univ. Microfilms Order No. 73-1140

Application of the perturbation method and Ritz energy method to the problem of nonlinear flexural gyrations of an untwisted, rotating cantilevered blade of symmetrical cross section, vibrating in the plane of rotation, is discussed. Numerical results for free and forced vibrations are obtained using the latter method for two cases: (1) a uniform blade and (2) a wedge shaped blade. Application of the Ritz energy method to the problem of nonlinear vibrations of a twisted rotating cantilevered blade subjected to Coriolis acceleration is included. Dissert. Abstr.

N73-25924 Pennsylvania Univ., Philadelphia.
MINIMUM WEIGHT DESIGN OF MULTILAYERED SHELLS AND SANDWICH PLATES Ph.D. Thesis
Nick John Pavicic 1972 141 p
Avail: Univ. Microfilms Order No. 73-1429

An analytical treatment of the optimal configurations for thin-walled, axisymmetric, laminated shells is presented. The laminae consist of uniaxially fiber reinforced materials with the fibers of the individual lamina oriented orthogonally to each other (cross-ply construction) or oriented symmetrically with respect to a surface at some arbitrary angle (angle-ply construction). Using membrane theory, in conjunction with the generalized Hill's yield criterion, shell thickness is found as a function of shell configuration, loading, fiber alignment, and material properties of the composite. This result is used for weight comparisons of different shells and determination of optimum shapes. Sandwich plate construction is also analyzed with optimum facing and core thickness derived for deflection and strength constraints. Dissert. Abstr.

N73-25925*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AXISYMMETRIC OSCILLATION OF A PARTIALLY LIQUID-FILLED CYLINDRICAL SHELL CONTAINER HAVING HEMISPHERICAL BULKHEADS
Rudolf F. Glaser Washington Jun. 1973 49 p refs
(NASA-TN-D-7318; M-218) Avail: NTIS HC $3.00 CSCL 20K

A spring-supported, cylindrical container of the length L having hemispherical bulkheads was considered. The analysis, however, is also valid for L = 0, which represents the cases of the sphere and hemisphere. Author

N73-25926# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
STRENGTHENING OF KEYED LONGITUDINAL CONSTRUCTION JOINTS IN RIGID PAVEMENTS Final Report, Apr. 1971 - May 1972
R. W. Grau Aug. 1972 126 p
(Contracts DOT-FA71WAI-218; F29601-71-X-0007)
(FAA-RD-72-106) Avail: NTIS HC $8.50

The performance of keyed and doweled longitudinal construction joints in rigid airfield pavement under mutiple wheel heavy gear loadings (MWHGL) was investigated along with the feasibility of strengthening existing keyed longitudinal joints. Results from the study show that: (1) performance of keyed joints on medium-strength foundations is marginal; (2) it is feasible to strengthen the keyed joints in existing rigid pavements that are founded on low- to medium-strength materials and are in good condition if the airfield is scheduled for MWHGL aircraft traffic; (3) keyed longitudinal construction joints in existing rigid pavements constructed on high-strength or stabilized soil foundations will probably perform satisfactorily under MWHGL aircraft traffic; (4) a sand-filter course beneath a pavement structure will be effective in minimizing subgrade pumping; (5) a 6-in.-thick stabilized base course placed over a low-strength subgrade is very effective in increasing the load-carrying capacity of a 10-in.-thick nonreinforced PCC pavement; and (6) doweled longitudinal construction joints in rigid pavements constructed on low-, medium-, and high-strength subgrades performed satisfactorily under MWHGL traffic. Author

N73-25927# Forest Products Lab., Madison, Wis.
EDGEWISE COMPRESSIVE AND FATIGUE PROPERTIES OF BRAZED TITANIUM SANDWICH CONSTRUCTIONS
G. H. Stevens 1973 18 p refs
(Contract F33615-72-M-5001)
(FPL-196) Avail: NTIS HC $3.00

Sandwich constructions having titanium facings brazed to titanium honeycomb core with aluminum braze were evaluated in edgewise compression under static and fatigue loading. Static edgewise compressive properties parallel to the core ribbon direction were evaluated at temperatures up to 1200 F. Edgewise compression fatigue and shear fatigue tests were made at 75 F. The edgewise compressive strength at elevated temperatures, compared to strength at 75 F, was about 60 percent at 800 F and about 20 percent at 1200 F. The maximum alternating stress at 30 million cycles in edgewise compression fatigue tests approached 90,000 pounds per square inch. The maximum alternating stress at 30 million cycles in flatwise shear fatigue tests approached 125 pounds per square inch. Author

N73-25928# Lockheed Missiles and Space Co., Palo Alto, Calif.
ECHO SIGNAL OF A FINITE SPHERICAL PULSE FROM AN ELASTIC CYLINDRICAL SHELL
Ia. A. Metsaveer [1973] 14 p refs Transl. into ENGLISH from Plikl. Mat. i Mekh. (Moscow), v. 37, no. 2, 1973 p 274-284
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An approximate method of calculating the echo signal of a finite centrally symmetric pressure pulse from an infinite elastic cylindrical shell in an infinite ideal compressible fluid is proposed. The shell motion is described by using a linear shell theory of the Timoshenko type. The problem is solved by a triple application of integral transformations; a Fourier transform in time and the longitudinal coordinate, and a Sommerfeld-Watson transform in the polar angle. Author

N73-25929*# Illinois Univ., Urbana.
THE CYCLIC MECHANICAL AND FATIGUE PROPERTIES OF FERROANELASTIC BETA PRIME GOLD CADMIUM Ph.D. Thesis. Final Report
Robert Stephen Karz 9 Apr. 1973 132 p refs
(Grant NGR-14-005-162)
(NASA-CR-131843) Avail: NTIS HC $8.75 CSCL 20K

The fatigue behavior of beta prime $Au_{1.05}Cd_{0.95}$ alloy was investigated and found to be exceptional for certain orientations with lives of 10,000 to 1,000,000 cycles at total strain amplitudes above 0.05 not uncommon. Fatigue lives were influenced principally by the stress level which controlled the amount of plastic deformation, and stress fatigue resistance was low compared with most metals. Failure always exhibited brittle characteristics. An algorithm was devised to predict mechanical behavior from the twin system orientations and was found in good agreement with experiment for longitudinal strains above 0.04. The cyclic mechanical properties were examined, and a model for the behavior was proposed utilizing previous theories of the restoring force and the Peierls-Nabarro stress for twinning and new concepts. Gold-cadmium was found to have certain strain fatigue resistant applications, particularly in electronics where the alloy's high electrical conductivity is utilized. Author

N73-25930# Defence Standards Labs., Maribyrnong (Australia).
THE INFLUENCE OF GEOMETRY ON THE NATURAL FRAGMENTATION OF STEEL CYLINDERS
B. Walsh Jan. 1973 40 p refs
(DSL-Rept-533) Avail: NTIS HC $4.00

The influence of variation in cylinder geometry on the fragmentation and mode of fracture of internally-detonated steel cylinders made from an annealed medium-carbon steel was investigated. The two principal geometric parameters chosen for study were wall thickness and C/M ratio (the ratio of the weight of high explosive filling to that of the cylinder material). For cylinders of constant C/M ratio but varying wall thickness, a scaling relationship was found to apply, the fragmentation varying in proportion to the original cylinder weight. In cylinders of increasing C/M ratio, where the wall thickness was kept constant, a continuous increase in the fineness of fragmentation was observed, and this could be characterized by a simple mathematical expression. Author

N73-25931# Hanford Engineering Development Lab., Richland, Wash.

IRRADIATION STRENGTHENING AND FRACTURE EMBRITTLEMENT OF A533-B PRESSURE VESSEL STEEL PLATE AND SUBMERGED ARC WELD

J. A. Williams and C. W. Hunter Apr. 1972 28 p refs Presented at Symp. on the Effects of Radiation on Structural Mater., Los Angeles, 26-28 Jun. 1972

(Contract AT(45-1)-2170)

(HEDL-SA-323; Conf-720604-6) Avail: NTIS

Plate and weld material of ASTM A533 Grade B, Class 1 steel was characterized for irradiation strengthening and fracture embrittlement. Plane strain fracture toughness, in the longitudinal orientation was determined. Yield strength was more sensitive to irradiation strengthening than the ultimate strength and the yield strength increased as a function of fluence and temperature. The fracture toughness of ASTM A533-B submerged-arc weldment metal exhibited a marked sensitivity for irradiation embrittlement. The yield and ultimate tensile strengths of ASTM A533-B sub-arc weld were determined. Irradiation strengthening of weld yield properties is slightly greater than the longitudinal base properties. Author (NSA)

N73-25932# Watervliet Arsenal, N.Y.

A MODIFIED COLLOCATION METHOD FOR C-SHAPED SPECIMENS

M. A. Hussain, W. E. Lorensen, D. P. Kendall, and S. L. Pu Feb. 1973 32 p refs

(DA Proj. 1F0-61102-A-35D)

(AD-758849; R-WV-T-X-6-73) Avail: NTIS CSCL 20/11

The stress intensity factor for a thick-walled cylindrical section with a straight, radial crack has been obtained by a modified boundary collocation method. The results obtained by this method are in good agreement with previously obtained experimental results. The application of this method to other component configurations can give an accurate K-calibration.

Author (GRA)

N73-25933# Liege Univ. (Belgium). Lab. de Techniques Aeronautiques et Spatiales.

DUAL ANALYSIS BY FINITE ELEMENTS LINEAR AND NONLINEAR APPLICATIONS Final Scientific Report, Oct. 1968 - Sep. 1970

B. Fraeijs DeVeubeke, G. Sander, and P. Beckers Dec. 1972 299 p refs

(Contract F61052-69-C-0004; AF Proj. 1467)

(AD-758790; SA-22; AFFDL-TR-72-93) Avail: NTIS CSCL 20/11

The report presents the results obtained during the aforementioned period concerning the linear and non linear applications of the dual analysis technique. New formulation for finite element derivation are proposed including equilibrium, conforming and hybrid elements. A new method of solution of the structural problem is based on the stress function formulation. The slab analogies are used to discover additional finite element families. A useful complementary energy principle is derived for large deformations. The stability criterion is obtained from the second variation of the total energy. A non linear shell theory is presented which avoids the difficulties of defining the constitutive equations. A computer program for linear applications is documented.

Author (GRA)

N73-25934# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

NONLINEAR FORCED VIBRATIONS OF ELASTIC STRUCTURES

Lawrence W. Rehfield Feb. 1973 33 p refs

(Grant AF-AFOSR-2479-73; AF Proj. 9782)

(AD-758810; GIT-AER-SM-1; AFOSR-73-0557TR) Avail: NTIS CSCL 20/11

The general approach to nonlinear free vibration of elastic structures recently presented by Rehfield is extended in this report to the case of forced vibration. It is assumed that the structure is excited by a disturbing force which is a harmonic function of time and is spatially distributed so as to excite only a single mode. General results are presented along with applications to the vibration of beams and rectangular plates. Other solution methods are compared with the general theory for the beam and the results are found to be in complete agreement.

Author (GRA)

N73-25935# Notre Dame Univ., Ind. Solid Mechanics Group.

GENERAL ELASTIC-PLASTIC INSTABILITY OF RING STIFFENED CYLINDRICAL SHELLS UNDER EXTERNAL PRESSURE

Lawrence H. N. Lee Feb. 1973 76 p refs

(Contract N00014-67-A-0242-0006)

(AD-757750; SM-156) Avail: NTIS CSCL 13/13

A variational principle and associated criteria on bifurcation and stability of elastic-plastic solids, which are expressed in terms of Lagrangian variables, are described. The principle is employed to study the effects of prebuckling deformation and yield surface corners on the inelastic asymmetric buckling of a ring-stiffened cylindrical shell under external pressure. The shell is made of a work hardening material having incremental type constitutive relationships associated with either Mises's yield surface or a yield surface with corners. An incremental Rayleigh-Ritz numerical method is employed to determine the non-linear deformation process and asymmetric bifurcation pressure. Numerical results are obtained and compared with available experimental results. Author (GRA)

N73-25936# Aerospace Corp., El Segundo, Calif.

A STATISTICAL THEORY FOR THE FRACTURE OF BRITTLE STRUCTURES SUBJECTED TO NONUNIFORM POLYAXIAL STRESSES

Samuel B. Batdorf and James G. Crose 26 Apr. 1973 36 p refs

(Contract F040701-72-C-0073)

(AD-759805; TR-0073(3450-76)-2; SAMSO-TR-73-162) Avail: NTIS CSCL 20/11

A weakest link theory for macroscopically homogeneous isotropic materials containing uniformly distributed, randomly oriented cracks is developed under the assumption that fracture depends only on the stress normal to a crack plane. The function representing the number of cracks failing at each value of normal stress is expanded as a Taylor series with coefficients determined from tensile test data. This function is used without additional assumptions to determine the probability of fracture under arbitrary stress conditions. The results can be readily incorporated into a finite element code to predict the failure probability of any structure to which the code applies.

Author (GRA)

N73-25937# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.

STABILITY OF PURE HOMOGENEOUS DEFORMATION OF AN ELASTIC CUBE UNDER DEAD LOADING

R. S. Rivlin Mar. 1973 22 p refs

(Contract N00014-67-A-0370-0001)

(AD-758700; CAM-100-18) Avail: NTIS CSCL 20/11

A cube of incompressible neo-Hookean material is subjected to a pure homogeneous deformation by three similar pairs of equal and opposite forces, acting normally to its faces and distributed uniformly over them. It is found that one, or seven, equilibrium states are possible, depending on the magnitude of the applied forces. The stability of the various equilibrium states is investigated with respect to arbitrary infinitesimal superposed deformations. (Author Modified Abstract) GRA

N73-25938# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EMPLOYMENT OF THE STATISTICAL METHOD TO INVESTIGATE THE STABILITY OF A CYLINDRICAL SHELL UNDER THE INFLUENCE OF AXIAL FORCES

G. E. Bagdasaryan and V. Ts. Gnuni 7 Mar. 1973 9 p refs Transl. into ENGLISH from the monograph "Problemy Nadezhnosti v Stroitelnoi Mekhanike" Erevan, Jun. 1968 p 160-162

(AF Proj. 782)

(AD-759394; FTD-HT-23-226-73) Avail: NTIS CSCL 20/11

A closed, circular, cylindrical shell is considered with thickness h, length l, and radius R. It is assumed that the shell is loaded with uniformly distributed longitudinal forces P applied at distance z sub zero from the edge of the mean (coordinate) surface. These forces cause an axisymmetric momentary strained state which, with specific relationships of the parameters of the problem,

may prove to be unstable. On the assumption that z sub zero is a random value with a given law of statistical distribution, the corresponding law of statistical distribution is determined for critical forces. Author

N73-25939# · Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHANGE IN THE FINE STRUCTURE OF NICKEL CHROMIUM HEAT RESISTANT ALLOYS DURING CREEP
S. T. Kishkin, E. V. Polak, L. P. Sorokina, and M. P. Usikov 3 Apr. 1973 20 p refs Transl. into ENGLISH from the publ. "Splavy Tsvetnykh Metallov" USSR, 1972 p 123-128
(AD-759233; FTD-HT-23-152-73) Avail: NTIS CSCL 11/6

The problem of creep and the heat resistance of alloys has been the subject of numerous studies and generalizations. In this work a diffraction electron microscope was used to study the role of crystal lattice defects and their interaction with phase particles in the behavior of alloys on a nickel-chromium base during creep at a temperature above 0.5 T (melt). Studies were also made of certain structural factors which ensure increased resistance to creep. GRA

N73-25940# George Washington Univ., Washington, D.C. Inst. for the Study of Fatigue Fracture and Structural Reliability.
PRECIPITATE SIZE AND DISTRIBUTION EFFECTS ON FATIGUE CRACK INITIATION AND PROPAGATION IN A HIGH STRENGTH STEEL
Charles M. Gilmore and William A. Wood Mar. 1973 13 p refs
(Contract N00014-67-A-0214-0011)
(AD-759048; TR-13) Avail: NTIS CSCL 11/6

It has been observed that high yield strength metals do not necessarily exhibit an equally high fatigue strength. Thus the dependence of fatigue failure on the precipitate size and distribution is investigated. Also, it is proposed that the permanent axial strain resulting from cyclic torsion is indicative of the metal response to cyclic loading. Microscopic observation of the failed specimens showed that failure at plus or minus 0.005 in/in twist strain occurred by the propagation of a single shear macrocrack linking with shear microcracks. The initiation of the shear microcracks was found to depend upon the precipitate size and distribution With fine particles localized deformation bands became microcracks, but with coarser particles crack initiation began at the particle-matrix interface. (Author Modified Abstract) GRA

N73-25941# Panametrics, Inc., Waltham, Mass.
MEASUREMENT OF ELASTIC MODULI OF MATERIALS AT ELEVATED TEMPERATURE Quarterly Progress Report
Emmanuel P. Papadakis, Kenneth A. Fowler, Lawrence C. Lynnworth, Edmund H. Carnevale, and James Chen 14 Feb. 1973 52 p refs
(Contract N00014-73-C-0023; NR Proj. 384-320)
(AD-759060; QPR-2) Avail: NTIS CSCL 14/2

The report contains new data on modulus and attenuation at elevated temperatures. It also contains theoretical calculations pertaining thereto. Specific topics discussed include the following: Measurements on remendur to 1000C; Corrections for spurious echoes in wire experiments; Forming graphite specimens for thin-wire ultrasonic measurements; Fourier spectrum analysis and synthesis of pulses. GRA

N73-25942# Stanford Univ., Calif. Dept. of Applied Mechanics.
DYNAMIC BEHAVIOR AND STABILITY OF SOLIDS AND STRUCTURES Interim Scientific Report, 1 Apr. 1972 - 31 Mar. 1973
George Herrmann 31 Mar. 1973 12 p refs
(Grant AF-AFOSR-1905-70; AF Proj. 9782)
(AD-759558; AFOSR-73-0707TR) Avail: NTIS CSCL 20/11

The report contains results obtained from research performed on the structural properties of various materials and various geometric configurations. GRA

N73-25943# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
VIBRATIONS OF VISCOELASTIC BODIES WITH SMALL LOSS TANGENTS: CORRESPONDENCE PRINCIPLE AND APPLICATION TO COMPOSITES
Zvi Hashin Jul. 1972 21 p refs
(Contract F44620-71-C-0100; AF Proj. 9782)
(AD-759260; MED-37; AFOSR-73-0638TR) Avail: NTIS CSCL 20/11

The correspondence principle for vibration of viscoelastic bodies is specialized to the case of small loss tangents resulting in considerable simplification. The present principle facilitates analytical solution of viscoelastic vibration problems and permits easy numerical solution of viscoelastic vibration problems. Author (GRA)

N73-25944# Army Foreign Science and Technology Center, Charlottesville, Va.
CARRYING CAPACITY OF CYLINDRICAL SHELLS EXPOSED TO DYNAMIC EXTERNAL PRESSURE
Yu. K. Bivin and A. A. Naida Jan. 1973 10 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 6, no. 10, 1970
(AD-759103; FSTC-HT-23-1386-72) Avail: NTIS CSCL 20/11

The report presents experimental results used in determining the limits of dangerous and safe dynamic external pressures changing both in time and on the shell surfaces according to various rules. The theoretical evaluation of these limits is carried out on the basis of linear theory related to shells. Different modes of load application were carried out using a rigid sample which had the same external geometric form as the shell; the pressure sensors were built into the walls of the rigid sample. The tests have indicated that pressures of the same magnitude are the same on the rigid model and on the chamber walls. (Author Modified Abstract) GRA

N73-25945# Naval Ordnance Lab., White Oak, Md. Explosion Dynamics Div.
ELECTRICAL POLARIZATION AND RESISTANCE MEASUREMENTS IN SILICON UNDER SHOCK WAVE COMPRESSION
J. W. Forbes, H. D. Jones, and N. L. Coleburn 28 Feb. 1973 34 p refs
(AD-759003; NOLTR-73-2) Avail: NTIS CSCL 20/12

The electrical behavior of p-type silicon in the (111) orientation was studied under shock stresses from 8 kbar to 160 kbar. Positive electrical signals were induced in the crystals during passage of elastic shock waves. Maximum signal amplitude was detected below the Hugoniot elastic limit (55 kbar). Resistance vs stress measurements were made when the polarization signal was zero, i.e., no elastic waves were in the crystals. The resistance becomes very small near the elastic limit indicating that a metallic state may have been reached. At a 133 kbar stress level the resistance is significantly higher than at the elastic limit indicating that a phase transition has probably occurred. Contrary to the work of Gust and Royce, the work shows transitions only at the elastic limit and at 133 kbar. Author (GRA)

N73-25946# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
BUCKLING OF CYLINDRICAL PANELS UNDER NON-UNIFORM AXIAL COMPRESSION
David Durban and Josef Singer Aug. 1972 41 p refs
(Contract F61052-69-C-0040; AF Proj. 9782)
(AD-758833; TAE-136; AFOSR-73-0575TR; SR-4) Avail: NTIS CSCL 20/11

The buckling of cylindrical panels under non uniform axial compression is investigated. Various load distributions are considered including bending and concentrated load. Along the straight edges two types of boundary conditions are examined: SS3 and SS4. Along the curved edges only the classical SS3 boundary condition is considered. The analysis is based on Donnell's equations and the standard Galerkin procedure. Results show that the critical stress depends strongly on the load distribution and on the geometric parameter K*. The critical stress increases as K* decreases and as the load distribution becomes sharper. For K* approaching infinity the critical stress approaches asymptotically the value corresponding to the critical stress in uniform axial compression. No significant difference is found between the boundary conditions SS3 and SS4, the latter yielding slightly higher critical stresses. Author (GRA)

N73-25947# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
BUCKLING ANALYSIS OF ELASTICALLY CONSTRAINED CONICAL SHELLS UNDER HYDROSTATIC PRESSURE BY THE COLLOCATION METHOD
Avishi Shalev, Menahem Baruch, and Eliahu Nisim Nov. 1972 144 p refs
(Contract F44620-71-C-0116; AF Proj. 9782)
(AD-758834; TAE-137; AFOSR-73-0576TR) Avail: NTIS CSCL 20/11

The present work presents a collocation method for numerical solution of buckling problems. Several such problems are solved and physical and mathematical conclusions are drawn. The collocation method is proposed as an alternative to the conventional ones, which either failed to yield complete solutions or are too cumbersome in application. A collocation method entails two major difficulties: (a) choice of the optimal collocation points, (b) efficient determination of the eigenvalue from the stability determinant. These two difficulties are solved in the first stages of the study. The application of the method is demonstrated on several familiar buckling problems; axially loaded columns under different boundary conditions, simply-supported columns with varying cross section in axial compression, and conical shells of various geometries subjected to hydrostatic pressure under the four SS1-SS4 boundary conditions. (Author Modified Abstract) GRA

N73-25948# Naval Postgraduate School, Monterey, Calif.
CONSISTANT STRESSES FOR THE FINITE ELEMENT STIFFNESS METHOD M.S. Thesis
William Henry Conley, Jr. Dec. 1972 103 p refs
(AD-758675) Avail: NTIS CSCL 20/11

Conjugate basis functions which are continuous throughout a model are used to approximate a stress field. This conjugate approximation has less mean error than approximations calculated using conventional finite element methods and is a better approximation at extreme values of stress. This thesis consists of two major parts. The appropriate analytic expressions for conjugate stress fields are set forth and applied to the constant strain triangle finite element. Analyses are then performed with these new stress calculations and the results compared to some previous stress calculations. Author (GRA)

N73-25949# Biot (Maurice A.), Brussels (Belgium).
MECHANICS AND THERMOMECHANICS Interim Scientific Report, 15 Feb. 1972 - 14 Feb. 1973
Maurice A. Biot 15 Feb. 1973 18 p refs
(Contract F44620-71-C-0092; AF Proj. 9782)
(AD-758884; AFOSR-73-0558TR; ISR-2) Avail: NTIS CSCL 20/11

Two subjects were developed. Part I provides further development of the nonlinear mechanics of fluid-saturated porous solids. The analysis is carried out in the context of the Cartesian definition of finite strain with special emphasis on the semi-linear properties of a large category of realistic porous solids. Drastic simplifications are thus introduced in the physical description and in the analysis. A variational approach and corresponding Lagrangian equations are also developed in the context of semi-linearity. Part II deals with the non-linear theory of thermoelasticity on the basis of irreversible thermodynamics, and a Cartesian definition which are applicable to non-linear thermal stress-analyses and post-buckling behavior. The theory puts the thermodynamics of elastic stability in a new light and provides the foundation for a large variety of finite element methods. The concept of finite Cartesian strain is also given further extension. Author (GRA)

N73-25950# Washington Univ., Seattle. Dept. of Mechanical Engineering.
CRACK APPROACHING A HOLE
A. S. Kobayashi, B. N. Johnson, and B. G. Wade Mar. 1973 33 p refs
(Contract N00014-67-A-0103-0018; NR Proj. 064-478)
(AD-759734; TR-16) Avail: NTIS CSCL 20/11

Effects of region of stress concentration ahead of a running crack in Homalite-100 sheets with a centrally located hole were studied by dynamic photoelasticity. Mode I dynamic stress intensity factors and corresponding dynamic strain energy release rates and crack velocities as well as the corresponding Modes I and II static stress intensity factors, static strain energy release rates and strain energy density factors were determined. (Author Modified Abstract) GRA

N73-25951# BLM Applied Mechanics Consultants, Champaign, Ill.
PERIODIC EXCITATION OF A FINITE STANDARD LINEAR VISCOELASTIC SOLID
Apr. 1973 92 p refs
(Contract DACA23-70-C-0077)
(AD-759485; CERL-TR-S-21) Avail: NTIS CSCL 20/11

The investigation examines the response of a finite three-dimensional standard linear viscoelastic solid to periodic excitation. The theory is based upon the correspondence principle that exists between a viscoelastic body and an elastic body. The general theory is specialized for a circular cylindrical body bonded to a rigid base and shaken by a prescribed oscillation of a circular rigid plate bonded concentrically to the other end. Four types of motion of the driving plate are treated, namely (1) a simple harmonic translation of the plate perpendicular to its plane, (2) an angular oscillation of the plate about its axis, (3) a simple harmonic translation of the plate in its plane, (4) an angular oscillation of the plate about a diameter. (Author Modified Abstract) GRA

N73-25040 Ministry of Supply, London (England).
THE BUCKLING OF A PRESSURIZED STIFFENED CYLINDER UNDER AXIAL LOAD
K. I. McKenzie *In* ARC Aerodyn. Res. Progr., including Turbine, Nozzle, Flutter, and Instrumentation Studies, Vol. 2 1971 p 1309-1324 refs (For availability see N73-25020 16-01)
(ARC-R/M-3198; RAE-R-STRUCT-247)

N73-25544* TRW Systems Group, Redondo Beach, Calif.
APPLICATIONS OF HOLOGRAPHY TO WAVE PROPAGATION IN SHELLS AND TO VIBRATION AT HIGH TEMPERATURE
D. A. Evensen and R. Aprahamian *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 27-34 refs (For availability see N73-25540 16-16)
(Contracts NAS1-9876; NAS1-10169)
CSCL 20E

N73-25558* Arkansas Univ., Fayetteville. Graduate Inst. of Technology.
OPTICAL CORRELATION EVALUATION OF SURFACE DEFORMATION DUE TO FATIGUE
Robert L. Bond, Robert E. Beissner (Southwest Res. Inst.), James Lankford, Jr. (Southwest Res. Inst.), and William W. Bradshaw (Southwest Res. Inst.) *In* NASA. Marshall Space Flight Center Holography and Opt. Filtering 1973 p 177-182 ref (For availability see N73-25540 16-16)
CSCL 20K

N73-25559* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLDER JOINT FATIGUE MEASUREMENT BY OPTICAL CROSS CORRELATION
Rodney W. Jenkins and Melvin C. McIlwain *In its* Holography and Opt. Filtering 1973 p 183-192 refs (For availability see N73-25540 16-16)
CSCL 20K

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-25952* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ABLATIVE SYSTEM Patent

Vernon H. Gray, inventor (to NASA) Issued 13 Mar. 1973 5 p Filed 4 Jun. 1971 Supersedes N72-22944 (10 - 13, p 1816) Continuation-in-part of US Patent Appl. SN-47063, filed 17 Jun. 1970
(NASA-Case-LEW-10359-2; US-Patent-3,720,075; US-Patent-Appl-SN-150215; US-Patent-Class-62-467; US-Patent-Class-60-200A; US-Patent-Class-60-265; US-Patent-Class-60-267; US-Patent-Class-102-105; US-Patent-Class-244-117A; US-Patent-Appl-SN-47063) Avail: US Patent Office CSCL 20M

A carrier liquid containing ablative material bodies is connected to a plenum chamber wall with openings to a high temperature environment. The liquid and bodies pass through the openings of the wall to form a self replacing ablative surface. The wall is composed of honeycomb layers, spheres containing ablative whiskers or wads, and a hardening catalyst for the carrier liquid. The wall also has woven wicks of ablative material fibers that extend through the wall openings and into plenum chamber which contains the liquid.

Official Gazette of the U.S. Patent Office

N73-25953 Washington Univ., Seattle.
THE VERY LOW TEMPERATURE HEAT CAPACITY OF SUBMONOLAYER HELIUM FILMS ON GRAPHITE Ph.D. Thesis
Eugene Otis McLean 1972 112 p
Avail: Univ. Microfilms Order No. 72-28633

The heat capacity of submonolayer helium films adsorbed on exfoliated graphite in the temperature range of 0.04 K to 4.2 K was studied. Argon, helium -3, and helium -4 adsorption isotherms were taken on the graphite substrate to determine monolayer capacity. For a large range in coverage and temperature the films give the constant C/Nk approximately 1 expected from an ideal two-dimensional (2-D) gas. There are, however, certain anomalous regions in which the heat capacity data gives evidence of phase transitions. For coverages $X < 0.4$ K, the He 4 data shows a peak occurring at T approximately 1.2 K. The structure of this peak agrees qualitatively with a theory attributing the peak to 2-D Bose condensation allowed by weak, long-range adsorption potential variations. Dissert. Abstr.

N73-25954 Polytechnic Inst. of Brooklyn, N.Y.
A NEW ANALYTICAL SOLUTION OF THE INVERSE HEAT CONDUCTION PROBLEM Ph.D. Thesis
Jamal Khan 1972 117 p
Avail: Univ. Microfilms Order No. 72-28250

An analytical solution of the inverse problem of transient heat conduction was developed by means of Laplace transform technique. The analysis utilizes temperature histories from two interior positions and predicts temperatures beyond these locations in either direction. The solution appears as a series of repeated integrals of the complementary error function which converges very fast as either the order of the integral or the argument of the error function increases. The method permits replacement of the prescribed interior temperature histories by power and quasipower series approximations which are fitted to the data by the least squares technique. Solutions are obtained for a one-dimensional heat flow in a finite slab, a sphere, and a cylinder. Dissert. Abstr.

N73-25955 Delaware Univ., Newark.
STUDIES ON THERMAL CONDUCTION IN RAREFIED GASES Ph.D. Thesis
Tzy Ken Shih 1972 162 p
Avail: Univ. Microfilms Order No. 72-32018

Problems of thermal conduction in a monatomic rarefied gas confined within two concentric cylinders or spheres were studied by the four-moment method. Two different models of distribution functions, namely the two-sided Maxwellian distribution and the bimodal two-stream distribution, were used as the weighting function in the Maxwell's equation of transfer. In the linear case of the small temperature difference between two solid boundary surfaces, both models eventually led to identical analytic solutions. As for the nonlinear case, i.e., the temperature difference being finite, different types of solutions were obtained. In using the two-sided Maxwellian distribution function, a series expansion technique was used and closed-form solutions were achieved. On the other hand, for the case of bimodal two-stream distribution function, exact numerical solutions were obtained through an iteration scheme on a constraint equation resulted from the boundary condition. Dissert. Abstr.

N73-25956 Minnesota Univ., Minneapolis.
UPPER BOUND ON HEAT TRANSFER ACROSS A POROUS FLUID LAYER HEATED FROM BELOW Ph.D. Thesis
Ved Prakash Gupta 1972 143 p
Avail: Univ. Microfilms Order No. 72-32290

An upper bound is found for the heat transfer across a porous fluid layer heated from below. The investigation extends the work done by Howard, Busse, and Chan for the pure fluid layer case, and the work done by Busse and Joseph for the porous layer case. An additional, physically relevant, constraint is imposed on the variational problem by setting the Darcy-Prandtl number to zero. This lowers the upper bound to within the range of experimental results. The theory also predicts a discontinuity in the curvature of the heat transfer curve at a Rayleigh number of 221.5. This is in agreement with the experimentally observed results which indicate a change in the nature of the convective heat transfer in the neighborhood of this Rayleigh number. Dissert. Abstr.

N73-25957 Stevens Inst. of Tech., Hoboken, N.J.
SPECIFIC HEAT MEASUREMENTS OF He-4 MONOLAYERS AT LOW TEMPERATURES Ph.D. Thesis
Mahadev Parameswaran 1972 248 p
Avail: Univ. Microfilms Order No. 72-31174

Specific heat measurements were made on submonolayer films of helium on three different substrates - bare sintered copper, monolayer argon-coated copper and monolayer neon-coated copper. The measurements were made in the temperature range 0.8 K to 4.3 K. It was found that besides the He 4 films, the substrate coating in the case of neon (monolayer) provided a measurable signal and hence an attempt was made to analyze these data. In addition, although a monolayer of argon had a lot of scatter associated with the data two layers of argon were deposited on the copper and measurements were made. It was found that the two layer argon signal could be measured. Attempts at interpreting the data on the coatings in terms of a 3-D Debye solid model indicates that while a reasonably good fit was obtained for neon no such fit was possible for argon. Neither the argon or neon data could be interpreted in terms of a 2-Debye solid. In the case of helium, exact interpretation of the data on bare copper substrate was not possible due to the heterogeneity of the substance, however a qualitative discussion is presented. Dissert. Abstr.

N73-25958 Utah Univ., Salt Lake City.
ACOUSTIC COMBUSTION INSTABILITY IN SOLID PROPELLANT COMBUSTORS Ph.D. Thesis
Philip Tsungwen 1972 103 p
Avail: Univ. Microfilms Order No. 72-1602

Problems related to acoustic combustion instability in solid propellant rockets are discussed. Coupled acoustic cavities with mass flux across a common boundary are studied. Since the propellant grain in a solid rocket motor may assume various configurations to meet specific performance criteria, physical models considering two or more wave-carrying systems coupled together so that acoustic motion of each is affected by the other are required in the study of acoustic instability in some motor designs. Linear analyses employing both one-dimensional and three-dimensional flow models of the T-burner are studied to resolve which is the more appropriate representation of the growth of acoustic waves in the T-burner geometry. The present analysis shows that both models yield an identical expression for the acoustic growth rate of dominant longitudinal modes in the T-burner if properly formulated. Dissert. Abstr.

N73-25959 Houston Univ., Tex.
SCALE-UP METHODS FOR HEAT TRANSFER MODELS WITH COUPLED CONDUCTION, CONVECTION AND RADIATION Ph.D. Thesis
Manohar Singh Sohal 1972 88 p
Avail: Univ. Microfilms Order No. 72-32700

In order to predict the thermal behavior of systems, a theoretical and experimental study of the scaling of thermal models is undertaken. Consider a semi-infinite thin plate with

transparent air flowing over one face and the other face insulated, involving uniform internal energy generation and conduction heat transfer. Externally heat is rejected to the flowing air by convection and radiation. The plate temperature can be expressed by a non-linear, singular, integro-differential equation which has to be solved numerically as the analytical solution is not available. The present results compare satisfactorily with results available in the literature. The effect of conduction and radiative transfer is also studied. Dissert. Abstr.

N73-25960# Leeds Univ. (England).
HIGH TEMPERATURE BULLETIN, NO. 32
1973 26 p
Avail: NTIS HC $3.50

Abstracts of papers and reports of research at 1800 C and above are presented. The abstracts are grouped in the following fields: flames and combustion, lasers, arcs and sparks, shock waves and detonations, high temperature chemistry, refractory materials, plasmas, high temperature apparatus, radiation and spectra, techniques for measuring high temperatures, and transport phenomena. F.O.S.

N73-25961*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ANALYSIS OF A CHARRING ABLATOR WITH THERMAL NONEQUILIBRIUM, CHEMICAL KINETICS, AND MASS TRANSFER
Ronald K. Clark Washington Jun. 1973 78 p refs
(NASA-TN-D-7180; L-8670) Avail: NTIS HC $3.00 CSCL 20M

The differential equations governing the transient response of a one-dimensional ablative thermal protection system are presented for thermal nonequilibrium between the pyrolysis gases and the char layer and with finite rate chemical reactions occurring. The system consists of three layers (the char layer, the uncharred layer, and an optical insulation layer) with concentrated heat sinks at the back surface and between the second and third layers. The equations are solved numerically by using a modified implicit finite difference scheme to obtain solutions for the thickness of the charred and uncharred layers, surface recession and pyrolysis rates, solid temperatures, porosity profiles, and profiles of pyrolysis-gas temperature, pressure, composition, and flow rate. Good agreement is obtained between numerical results and exact solutions for a number of simplified cases. The complete numerical analysis is used to obtain solutions for an ablative system subjected to a constant heating environment. Effects of thermal, chemical, and mass transfer processes are shown. Author

N73-25962*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
SIMULATION EXPERIMENTS USING HYDROGEN/OXYGEN GAS MIXTURES IN A HIGH PRESSURE DETONATION TUBE
Final Report
Harold Hopkins, Wayne Konopka, Jarvis Leng, and Richard Oman
May 1973 155 p refs
(Contract NAS9-12447)
(NASA-CR-128955; MSC-05836) Avail: NTIS HC $9.75 CSCL 20M

Hydrogen/oxygen combustion products generated in a detonation tube are used to simulate rocket exhaust plumes and reentry aerothermodynamic flow fields. For individual titles, see N73-25963 through N73-25964.

N73-25963* Grumman Aerospace Corp., Bethpage, N.Y.
HIGH REYNOLDS NUMBER ROCKET PLUME SIMULATION, PART 1
In its Simulation Expt. using Hydrogen/Oxygen Gas Mixtures in a High Pressure Detonation Tube May 1973 p 3-103 refs (For availability see N73-25962 16-33)
CSCL 20M

A backward running detonation wave shock tube is used to simulate rocket plumes arising from oxygen/hydrogen mixtures. This detonation tube technique provides correct hydrogen/oxygen plume enthalpy, chemistry, and flow geometry for LM simulation at a pressure that greatly reduces explosion hazards. G.G.

N73-25964* Grumman Aerospace Corp., Bethpage, N.Y.
SUBSTITUTE GAS FOR REENTRY AEROTHERMODYNAMIC SIMULATION, PART 2
In its Simulation Expt. using Hydrogen/Oxygen Gas Mixtures in a High Pressure Detonation Tube May 1973 p 105-138 refs (For availability see N73-25962 16-33)
CSCL 20M

The energy available in hypersonic ground test facilities is insufficient to reproduce the thermodynamic characteristics of reentry air. Use of H2/O2 combustion products for reentry aerothermodynamic simulation provides a simple density ratio correction to the measured Stanton number and appears to correct both windward and leeward data from air facilities to account for the different thermodynamic behavior of flight air. Author

N73-25965*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ATS-F RADIANT COOLER CONTAMINATION TEST IN A HYDRAZINE THRUSTER EXHAUST
Jose E. Chirivella 15 Apr. 1973 87 p refs
(Contract NAS7-100)
(NASA-CR-132988; JPL-TM-33-592) Avail: NTIS HC $6.50 CSCL 20M

A test was conducted under simulated space conditions to determine the potential thermal degradation of the ATS-F radiant cooler from any contaminants generated by a 0.44-N(0.1-lbf) hydrazine thruster. The radiant cooler, a 0.44-N(0.1-lbf)hydrazine engine, and an aluminum plate simulating the satellite interface were assembled to simulate their flight configuration. The cooler was provided with platinum sensors for measuring temperature, and its surfaces were instrumented with six quartz crystal microbalance units (QCM) to measure contaminant mass deposits. The complete assembly was tested in the molecular sink vacuum facility (Molsink) at the Jet Propulsion Laboratory. This was the first time that a radiant cooler and a hydrazine engine were tested together in a very-high-vacuum space simulator, and this test was the first successful measurement of detectable deposits from hydrazine rocket engine plumes in a high vacuum. The engine was subjected to an accelerated duty cycle of 1 pulse/min, and after 2-hr of operation, the QCMs began to shift in frequency. The tests continued for several days and, although there was considerable acticity in the QCMs, the cooler never experienced thermal degradation. Author

N73-25966*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLOW THROUGH A WIRE-FORM TRANSPIRATION-COOLED VANE
Albert Kaufman Washington Jun. 1973 26 p refs
(NASA-TN-D-7341; E-7385) Avail: NTIS HC $3.00 CSCL 20M

Results of recent research to develop techniques for analyzing coolant flow in transpiration-cooled vanes are summarized. Flow characteristics of the wire-form porous material are correlated; the effects on the flow characteristics of oxidation, coolant temperature, gas crossflow, and airfoil curvature are evaluated. An analytical method is presented for predicting coolant flows and pressures in a strut-supported vane. Author

N73-25967# ARO, Inc., Arnold Air Force Station, Tenn.
AN EFFICIENT NUMERICAL METHOD FOR STIRRED REACTOR CALCULATIONS
I. T. Osgerby Arnold AF Station, Tenn. AEDC Nov. 1972 56 p refs
(Contract F40600-73-C-0004; Grant AF-AFOSR-0001-72)
(AD-751462; AEDC-TR-72-164; AFOSR-72-0910TR) Avail: NTIS HC $5.00 CSCL 07B

An efficient method is presented for calculating chemical composition in a perfectly stirred reactor at a given pressure, stoichiometry, and mass flow per unit volume. Either temperature or enthalpy may be prescribed as the additional condition for the computations. By employing linearization techniques, the nonlinear equations of detailed finite rate chemical kinetic schemes reduced to a system of algebraic equations which are solved iteratively. No difficulties are experienced in obtaining converged solutions using the techniques described. A computer program

is presented for solution of problems with arbitrary fuel/oxidant combinations. Author

N73-25968# Advisory Group for Aerospace Research and Development, Paris (France).
THERMOPHYSICAL PROPERTIES OF SOLID MATERIALS. PROJECT SECTION 2: COOPERATIVE MEASUREMENTS ON HEAT TRANSPORT PHENOMENA OF SOLID MATERIALS AT HIGH TEMPERATURE
E. Fitzer (Karlsruhe Univ., West Germany) Mar. 1973 113 p refs
(AGARD-R-606; AGARD-606) Avail: NTIS HC $7.75

Measurements of heat transfer properties of solid materials at high temperatures are discussed. The range between 1,000 C and 3,000 C is examined. It is stated that exact information on the thermophysical properties of materials and on the temperature dependence must be considered as a precondition for the calculation of the behavior of structural elements during service, especially with respect to transient heating and cooling. Mathematical models are provided to quantify the heat loss characteristics. Specific materials are analyzed to determine their thermodynamic properties. Author

N73-25969*# Teledyne Brown Engineering, Huntsville, Ala. Science and Engineering.
HANDBOOK ON PASSIVE THERMAL CONTROL COATINGS Final Report
T. K. Mookherji and J. D. Hayes Apr. 1973 155 p refs
(Contract NAS8-25900)
(NASA-CR-124287; SE-SSL-1717) Avail: NTIS HC $9.75 CSCL 11C

A handbook of passive thermal control surfaces data pertaining to the heat transfer requirements of spacecraft is presented. Passive temperature control techniques and the selection of control surfaces are analyzed. The space environmental damage mechanisms in passive thermal control surfaces are examined. Data on the coatings for which technical information is available are presented in tabular form. Emphasis was placed on consulting only those references where the experimental simulation of the space environment appeared to be more appropriate. Author

N73-25970# Sandia Labs., Albuquerque, N.Mex.
HEAT TRANSFER IN INTRINSIC THERMOCOUPLES: APPLICATION TO TRANSIENT TEMPERATURE MEASUREMENT ERRORS
N. R. Keltner Jan. 1973 227 p refs Sponsored by AEC
(SC-RR-72-0719) Avail: NTIS

Intrinsic thermocouples are frequently used to measure rapidly varying surface temperatures on electrically conducting solids. Heat transfer between the substrate and the thermocouple introduces time lag errors into the measurements. To determine these errors, solutions for the interface temperature are obtained, for the case where the substrate undergoes a step temperature change, with both finite difference and analytical methods. The results indicate that the interface temperature response can be determined solely from the thermal properties of the materials. Comparison of the solution results with limited experimental results shows general agreement. Author (NSA)

N73-25971# Geological Survey, Washington, D.C.
THERMODYNAMIC CALCULATIONS Final Report
M. Nathenson 1973 33 p refs
(PB-214372/5; USGS-GD-73-001; Rept-24) Avail: NTIS HC $3.00 CSCL 07D

A computer program is developed which calculates equilibrium constants for a set of reactions at various temperatures from a file of enthalpies and free energies of formation, entropies, and heat capacities. The input data cards of stoichiometric coefficients use the file of species names and thermodynamic data to write a chemical equation and to calculate the equilibrium constants for the reaction at various temperatures. A sample data set useful in water chemistry studies is included. Author (GRA)

N73-25972# Naval Ordnance Lab., White Oak, Md.
INTERNAL BLAST DAMAGE MECHANISMS COMPUTER PROGRAM Final Report, Jun. 1971 - Feb. 1972
James F. Proctor 31 Aug. 1972 118 p refs
(AD-759002; NOLTR-72-231) Avail: NTIS CSCL 19/4

A computer program has been developed at NOL that describes the shock and blast loading characteristics of the detonation of a high explosive projectile internal to an aircraft structure; both shock wave and confined-explosion gas pressure loads are considered. With certain modifications, the program can be made applicable to any internal explosion irrespective of the type of confining configuration, e.g., a naval ship compartment, land vehicle, or building structure. Discussions are given on the general use and content of the program, the input options available in the code, and the technical aspects of the calculational methods used to determine shock loading functions, confined-explosion gas pressure, venting of the confined gases, and damage propagation to other areas of the aircraft. (Author Modified Abstract) GRA

N73-25973# Army Foreign Science and Technology Center, Charlottesville, Va.
COMBUSTION STABILITY THEORY FOR A SOLID PROPELLANT TREATED AS AN ELASTIC BODY
S. K. Aslanov 16 Feb. 1973 11 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), no. 2, 1971 p 94-99
(AD-759819; FSTC-HT-23-1383-72) Avail: NTIS CSCL 19/1

The combustion processes of a solid fuel are explored with relation to the phenomena of pulsation. GRA

N73-25974# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A USER'S GUIDE FOR THE COMPACT-TRANSPIRATION-COOLING (CTC) COMPUTER PROGRAM
Redfield W. Allen and Robb W. Newman Sep. 1972 135 p refs
(Contract N00017-72-C-4401)
(AD-759698; APL-TG-1179) Avail: NTIS CSCL 16/3

In the future, thermal protection of hypersonic flight leading edges may require using active transpiration cooling systems. To meet the space restriction placed on such systems by low drag requirements, a compact-plenum transpiration cooling system has been proposed. In the preliminary design of such a system parametric studies are required to determine the most effective flow control devices, porous matrix geometry, porosity, etc. To aid in this study, the IBM 360/91 PL/1 Compact Transpiration Cooling (CTC) computer program has been written. CTC computes transient temperatures, pressures, and mass-flow rates throughout the system from given aerodynamic flight data, transpirant flow rate, leading-edge geometry, and matrix porosity. This report is intended to provide the prospective user of CTC with an understanding of the ingredients of its subroutines as well as provide specific instructions for preparing a CTC Main program and interpreting its printout. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-25975 Northwestern Univ., Evanston, Ill.
THE EFFECTS OF TECHNO-ECONOMIC AND ORGANIZATIONAL FACTORS ON THE ADOPTION OF NASA-INNOVATIONS BY COMMERCIAL FIRMS IN THE US Ph.D. Thesis
Alok Kumar Chakrabarti 1972 409 p
Avail: Univ. Microfilms Order No. 72-32402

The relative importance of the techno-economic and organizational factors which affect the adoption of new technology in commercial firms was studied. Using NASA tech briefs containing ideas for new products and processes, it was possible to get access to 73 cases, 45 product and 23 process, where different decisions for adoption were made on 45 tech briefs. The data base obtained from the Project for Analysis of Technology Transfer at Denver Research Institute was used to define the population of cases. The study showed that the success of product and process innovations are related to different sets of factors.

An implication of these findings is that information dissemination systems should recognize this and adopt different strategies for dissemination of product and process innovations.
Dissert. Abstr.

N73-25976* + National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS, JANUARY 1973
1973 149 p refs
(NASA-SP-7039(02)-Sect-1) Avail: NTIS HC $3.00 CSCL 05B

This bibliography is issued in two sections: Section 1 - Abstracts, and Section 2 - Indexes. This issue of the Abstract Section cites 320 patents and applications for patents introduced into the NASA scientific and technical information system during the period of July 1972 through December 1972. Each entry in the Abstract Section consists of a citation, an abstract, and, in most cases, a key illustration selected from the patent or application for patent. This issue of the Index Section contains entries for 2353 patent and application for patent citations covering the period May 1969 through December 1972. The Index Section contains five indexes -- subject, inventor, source, number, and accession number. Author

N73-25977* + National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES
Jan. 1973 403 p refs
(NASA-SP-7039(02)-SECT-2) Avail: NTIS HC $3.00 CSCL 05B

For abstract, see N73-25976

N73-25978# Committee on Appropriations (U. S. House).
HUD-SPACE-SCIENCE-VETERANS APPROPRIATIONS FOR 1974. PART 2: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, NATIONAL SCIENCE FOUNDATION
Washington GPO 1973 1440 p refs Hearings before Comm. on Appropriations, 93d Congr., 1st Sess., 14 Mar. and 2 Apr. 1973
Avail: Subcomm. on HUD-Space-Sci.-Veterans

The hearings before a subcommittee of the Committee on Appropriations of the House of Representatives of the Ninety-Third Congress are presented. The 1974 appropriations for the Housing and Urban Development, National Science Foundation, and Veterans organizations are discussed. The proposed activities of the organizations are presented to justify the request for government funds to accomplish these activities. P.N.F.

N73-25979# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
AEROSPACE IN THE NEXT CENTURY
I. I. Glass Apr. 1973 99 p refs
(UTIAS-Rev-37) Avail: NTIS HC $7.00

Past, present, and future developments in aerospace engineering are discussed and treated as dynamic stages in man's exploration of space. A detailed historical account is provided of the progress made since the advent of primitive aviation designs to the latest advances of the Apollo, Skylab, and Space Shuttle efforts. The future of space exploration is then discussed in terms of planetary landings and unmanned probes of the other limits of the solar system. J.M.M.

N73-25980# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
[RESEARCH PROGRESS IN GAS AND PLASMA DYNAMICS, AERODYNAMICS, AND FLUID FLOW] Annual Progress Report, 1972
Dec. 1972 154 p refs
Avail: NTIS HC $9.75

The various studies reported consider design criteria of space structures, optical laser holography, spacecraft dynamics and control, development of mercury ion thruster, ionization measurements on helium, sonic boom simulation, construction of test facility for air cushion vehicles, simulation of boundary layer turbulence, etc. G.G.

N73-25981# Alpha Inst., Huntsville, Ala.
PATENT SURVEY: SEARCH OF US GOVERNMENT-OWNED PATENTS, CLEVELAND, OHIO
David J. Kieselbach 1 Jun. 1973 123 p
(Contract PO-3-45631)
Avail: NTIS HC $8.25

The billions of dollars spent on space exploration research and development has resulted in a large quantity of patents. The applicability of the technological advances identified with these patents is considered in terms of economic progress in the private sector. A large selection of these patents is presented along with their specifications and status of availability. J.M.M.

N73-25982*# Northwestern Univ., Evanston, Ill. Graduate School of Management.
INTERORGANIZATIONAL DECISION MAKING
Matthew F. Tuite, ed., Roger Chisholm, ed. (Memphis State Univ.), and Michael Radnor, ed. Chicago Aldine Publishing Co. 1972 312 p refs
(Grant NGL-14-007-058)
(NASA-CR-132995; LC-76-140007; ISBN-0-202-37001-1)
Avail: NTIS HC $17.75 CSCL 05A

The concepts and framework of interorganizational decision making are discussed along with the interorganizational decision making in a business context, at the government-business interface, and in government. Designing organizational structures for interorganizational decision making is also discussed. F.O.S.

N73-25983*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PUBLICATIONS OF THE JET PROPULSION LABORATORY: JANUARY - DECEMBER 1972
15 May 1973 189 p refs
(Contract NAS7-100)
(NASA-CR-132994; JPL-Bibl-39-14) Avail: NTIS HC $11.50 CSCL 05B

Abstracts are presented of technical reports resulting from JPL scientific and engineering work during 1972. F.O.S.

N73-25984*# National Academy of Public Administration, Washington, D.C.
MEETING THE NEEDS OF TOMORROW'S PUBLIC SERVICE: GUIDELINES FOR PROFESSIONAL EDUCATION IN PUBLIC ADMINISTRATION
Richard L. Chapman and Frederic N. Cleaveland Jan. 1973 78 p refs
(Contract NSR-09-046-001)
(NASA-CR-133036) Avail: NTIS HC $6.00 CSCL 05A

The educational programs for public administration were studied to develop guidelines for meeting the requirements of public service in the 1980's. The current state of education for public service is discussed along with a prospective view of the service over the next decade. Criteria for evaluating graduate programs are presented. F.O.S.

N73-25985# Honeywell, Inc., St. Paul, Minn.
DEVELOPMENT OF WEAPON DELIVERY MODELS AND ANALYSIS PROGRAMS. VOLUME 1: SYSTEM MODELING AND PERFORMANCE OPTIMIZATION
A. Ferit Konar Wright-Patterson AFB, Ohio AFFDL Apr. 1972 204 p refs
(Contract F33615-71-C-1059; AF Proj. 8219)
(AD-751505; HONEYWELL-12261-FR1-Vol-1; AFFDL-TR-71-123-Vol-1) Avail: NTIS HC $12.25 CSCL 19/4

The development of a dynamic precision weapon delivery system model for analyzing the effects of system parameters and disturbances on delivery performance is reported. A methodology of precision weapon delivery flight control design is developed, without considering the pilot as a control element. The developed model is general enough for use in piloted weapon delivery investigations. The aircraft model accommodates a wide variety of airframe nonlinear dynamics, control points and methods and measurement systems. The bomb model is general enough for a variety of dive-bomb angles, release altitudes and release speeds. The circular error probable (CEP) at impact is chosen as a measure of weapon delivery performance, and a technique is

developed for relating the effects of flight control parameters, airframe dynamics, measurement errors and gust disturbances to this measure by using the system model. Author

N73-25986# Honeywell, Inc., St. Paul, Minn.
DEVELOPMENT OF WEAPON DELIVERY MODELS AND ANALYSIS PROGRAMS. VOLUME 2: DOCUMENTATION OF THE ARMAMENT DELIVERY ANALYSIS PROGRAMMING SYSTEM (ADAPS)
A. Ferit Konar and Michael D. Ward Wright-Patterson AFB, Ohio AFFDL Apr. 1972 314 p refs
(Contract F33615-71-C-1059; AF Proj. 8219)
(AD-751506; HONEYWELL-12261-FR1-Vol-2; AFFDL-TR-71-123-Vol-2) Avail: NTIS HC $17.75 CSCL 19/4

The computer programs which implement the mathematical analyses and models developed in Volume I are described. The programs are developed in FORTRAN IV language. Extensive use of subroutines is made to provide programming flexibility when considering alternate airframe/dynamics/control points/measurement system combinations and their effect on weapon-delivery performance. A demonstration example is included in Volume 3 to illustrate how these programs are used and how the important error contributors to weapon-delivery performance are identified. Author

N73-25987# Honeywell, Inc., St. Paul, Minn.
DEVELOPMENT OF WEAPON DELIVERY MODELS AND ANALYSIS PROGRAMS. VOLUME 3: TESTING AND DEMONSTRATION OF THE ARMAMENT DELIVERY ANALYSIS PROGRAMMING SYSTEM (ADAPS)
A. Ferit Konar and Michael D. Ward Wright-Patterson AFB, Ohio AFFDL Apr. 1972 191 p
(Contract F33615-71-C-1059; AF Proj. 8219)
(AD-751527; HONEYWELL-12261-FR1-Vol-3; AFFDL-TR-71-123-Vol-3) Avail: NTIS HC $11.75 CSCL 19/4

The testing and use of the Armament Delivery Analysis Programming System is demonstrated by performing an analysis with a specified bomb (M-117) and an F-4 aircraft. The demonstration model revealed no appreciable performance difference between the time-invariant and time-varying optimal controllers for the weapon delivery process. The contribution matrix of the bomb indicated that the major contributors to the probable error are the velocity and the attitude-state errors at release. Author

N73-25988*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STUDY FOR IDENTIFICATION OF BENEFICIAL USES OF SPACE, PHASE 1. VOLUME 1: EXECUTIVE SUMMARY Final Report
10 Dec. 1972 25 p refs
(Contract NAS8-28179)
(NASA-CR-124260; DPD-296; DR-MA-04-Vol-1) Avail: NTIS HC $3.25 CSCL 05C

The technological effects of the Space Shuttle Program are considered in terms of the development of improved products, processes, and services aimed at benefitting the public from economic and sociological points of view. As such, an outline is provided for a large number of private organizations to suggest and identify specific areas of research and development which can most effectively be exploited in an extraterrestrial environment. J.M.M.

N73-25989*# Denver Research Inst., Colo. Industrial Economics Div.
THE NASA ROLE IN MAJOR AREAS OF HUMAN CONCERN: SAFETY
Feb. 1973 11 p refs
(Contract NASw-2362)
(NASA-CR-133051) Avail: NTIS HC $3.00 CSCL 14D

The role of NASA in the national attempt to minimize the occurrence and severity of accidents is described. Equipment and structure safety, industrial safety, and accident prevention are discussed. F.O.S.

N73-25990*# Denver Research Inst., Colo. Industrial Economics Div.
THE NASA ROLE IN MAJOR AREAS OF HUMAN CONCERN: TRANSPORTATION
Feb. 1973 14 p refs
(Contract NASw-2362)
(NASA-CR-133050) Avail: NTIS HC $3.00 CSCL 13F

After introducing some of the general factors that have affected progress in the transportation area, NASA program elements are examined to illustrate relevant points of contact. Interpretive steps are taken throughout the statement to show a few of the more important ways people's lives have been affected as a result of the work of NASA and other organizations functioning in this area. The principal documents used and interviews conducted are identified after the conclusion of this statement. This statement, it should be noted, is incomplete in many respects, primarily because it reflects only a small number of the technical, economic, and social forces affecting American life. Taken as a summary statement, however, it hopefully will provide a useful basis for better understanding NASA's role in the national attempt to upgrade the quality of transportation services. Author

N73-25991*# Southeastern State Coll., Durant, Okla. Technology Use Studies Center.
TECHNOLOGY UTILIZATION Quarterly Status Report, 1 Jan. - 31 Mar. 1973
C. Henry Gold, A. M. Moore, Bill Dodd, and Velma Dittmar Apr. 1973 122 p
(Contract NASw-2379)
(NASA-CR-132963; QSR-32) Avail: NTIS HC $8.25 CSCL 05B

Documentation is presented for selected transfer and impact reports provided to the business community, government agencies, and such other requestors as schools, universities, and health services. Statistical data are also included on the characteristics of the TUSC technical searches. Author

N73-25992# Naval Research Lab., Washington, D.C.
NRL PROGRESS REPORT, DECEMBER 1972
V. R. Deitz and E. J. Brooks Dec. 1972 62 p refs
(PB-215342/7) Avail: NTIS HC $3.00; also available on subscription $15.00/year domestic, $18.00/year foreign CSCL 05B

A progress report covering electronics, information systems, mathematics, metallurgy, optical physics, and radar is presented. Data are also given on the reaction of graphite with ozone as observed in scanning electron microscopy. E.H.W.

N73-25993# Metropolitan Washington Council of Governments, D.C.
URBAN IMPACT ON AREAS OF MAXIMUM ENVIRONMENTAL QUALITY WITHIN THE WASHINGTON METROPOLITAN AREA, 1971, VOLUME 4: SUPPLEMENT TO PRELIMINARY OPEN SPACE PLAN AND PROGRAM FOR METROPOLITAN WASHINGTON Final Report
Aug. 1972 48 p
(PB-214544/9) Avail: NTIS HC $4.50 CSCL 13B

This report analyzes, utilizing high altitude imagery, the observable evidence of urban activity upon 176,000 acres of open space in the Washington, D.C. SMSA. GRA

N73-25994# Temple, Barker and Sloane, Inc., Wellesley Hills, Mass.
GOVERNMENT ORGANIZATION FOR CIVIL AVIATION
Paul W. Cherington 9 Aug. 1972 28 p
(PB-215426/8; AAC-SPI-71-1) Avail: NTIS HC $3.00 CSCL 01B

A brief analysis is presented of what appears to be some of the present shortcomings in the federal organization area as it relates to aviation. A short history of the development of that subject is followed by a description of what appears to be the main organizational options and an analysis of those options in the light of what seem likely to be the major problems and issues of civil aviation. Author (GRA)

N73-25995# Informatics, Inc., Rockville, Md.
SELECTED MATERIAL FROM SOVIET TECHNICAL LITERA-

TURE, JANUARY 1973
Stuart G. Hibben 6 Mar. 1973 161 p refs
(Contract F44620-72-C-0053; ARPA Order 1622-4)
(AD-758784; AFOSR-73-0568TR) Avail: NTIS CSCL 05/2

The report includes abstracts and bibliographic lists on contractual subjects that were completed in January, 1973. The major topics are: laser technology, effects of strong explosions, geosciences, particle beams, and material sciences. A section on atmospheric physics and one on items of miscellaneous interest are included as optional topics. Laser coverage is generally limited to high power effects; all current laser material is routinely entered in the quarterly laser bibliographies. An index identifying source abbreviations and a first-author index to the abstracts are appended. Author (GRA)

N73-25996# Army Foreign Science and Technology Center, Charlottesville, Va.
FRENCH-SOVIET COOPERATION IN SPACE RESEARCH
E. Chugunov 11 Nov. 1972 5 p Transl. into ENGLISH from Pravda Ukrainy (USSR), no. 238 (8994), 16 Oct. 1971 p 4
(AD-759106; FSTC-HT-23-2-73) Avail: NTIS CSCL 22/1

Slightly more than 5 years have passed from the 1966 signing of an intergovernmental agreement between Soviet Union and France on cooperation in the field of the study and mastering of space for peaceful purposes. During this comparatively small period, the scientists of both countries have been successful in jointly accomplishing several space projects of extreme scientific and practical value. GRA

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Bioastronautics Data Book. Second Edition (NASA SP–3006)

This revision of the *Bioastronautics Data Book* represents an updating and expansion of a 1964 NASA document. The Second Edition was prepared under the guidance of Working Group 5 of the Committee on Hearing, Bioacoustics and Biomechanics of the National Academy of Sciences in order to bring together the essentials of the large body of human research information generated in recent years and to present it in a form suitable for engineers and others concerned with the development and evaluation of modern systems. The book deals with a substantial array of content areas within the broad domain of life sciences and presents primarily that information deemed of value for system design and evaluation. *Clothbound.* 948 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $7.50.

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